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Air



NETWORK DESIGN AND OPTIMUM SITE EXPOSURE CRITERIA FOR PARTICULATE MATTER



Network Design and Optimum Site Exposure Criteria for Particulate Matter

by

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SECTION 1

INTRODUCTION

The primary purpose of this document is to assist in planning a network of monitoring sites for measuring particulate matter. The measurements will conform to the new PM_{10} standard, which replaces the former TSP standard. As a secondary objective, this document will aid in understanding the relationship between PM_{10} measurements and the quality of air that is sampled. The information contained here will prove useful to both air quality surveillance personnel and the users of air quality monitoring data. In this document, the siting process is viewed dynamically.

Information received from monitoring sites can be used to feed back into the siting process in order to improve the site selections. The information can also be used to improve air quality simulation models or other analytical tools used in the siting process; however, the process of improving air quality models is not covered in this report.

Monitoring is undertaken to collect needed data. In planning a monitoring network, these data needs must be well defined and understood. This document provides suggestions for helping to identify what these data needs may be. The data needs may change with time as the monitoring results help characterize the local situation and as health effects research clarifies the significant characteristics of air quality exposure. These considerations apply especially to particulate matter, which is made up of highly variable components in space and time.

The major sections of this report treat the following topics:

- Characteristics of PM₁₀
- Monitoring objectives
- Elements of site selection
- ullet Methodology for siting PM $_{10}$ monitors
- Examples of siting studies.

 $^{^{\}rm 1}$ TSP refers to total suspended particulate matter, and PM $_{\rm 10}$ refers to particulate matter that includes particles in the nominal size range of 10 μm and smaller aerodynamic diameter.

The principal steps in the siting methodology described in Section 5 include the following:

- 1. Determine needs for monitoring data
- 2. Assemble and analyze available particulate matter data
- 3. Model levels of PM_{10}
- 4. Determine PM_{10} monitoring network requirements
- 5. Select location and placement of PM_{10} monitors
- Document and review site selection.

The appendixes include descriptions of sources of data that may be useful in the site selection process.

SECTION 2

CHARACTERISTICS OF PM10

PM10 is the indicator for the National Ambient Air Quality Standard (NAAQS) particulate matter, which replaces total suspended particulate matter (TSP). "PM10" means particulate matter with an aerodynamic diameter less than or equal to a nominal 10 μm , as measured by the reference method described in Appendix J, 40 CFR 50, and in accordance with 40 CFR 53, or as measured by an equivalent method designated in accordance with 40 CFR 53. In siting monitors for measuring PM10, it is desirable to understand the general principles that govern the generation, transformation, and removal of particulate matter; the basic workings of available instrumentation; and the significant factors that control the spatial and temporal patterns of PM10.

GENERAL PRINCIPLES

Particulate matter as an air pollutant includes a broad class of airborne liquid or solid substances that vary greatly in chemical and physical properties. One important characteristic is size, because larger particles are not collected in the human respiratory tract and are therefore not a health hazard. Because of irregularities in shape, density, composition, and structure of atmospheric aerosols, individual particles are conveniently characterized by their aerodynamic equivalent diameters (AED). Particles with the same fall velocity are defined as having the same AED, which for convenience is specified as the diameter of a uniform sphere with unit density that obtains the fall velocity (e.g., see Corn 1976).

Throughout this document, most references to particle size refer to AED. When the effects of particles on visibility and light scattering are considered, the use of a different definition of particle size more closely related to actual physical size may be necessary. The primary health hazards from particulate matter are due to its depositon in the human respiratory tract. The impact of particle size and chemical composition on the deposition process is discussed in the EPA staff review of the NAAQS for particulate matter (EPA 1981a).

The atmospheric aerosols that make up PM_{10} measurements will vary both in size distribution and in chemical composition. Generally, three distinct size modes are present, although the smallest size mode is often difficult to detect. This is shown by the data in Figure 1, which were collected in the California ACHEX study (Whitby 1980). The smallest size mode (<0.1 μ m) is short-lived and most often observed as a distinct class near combustion sources. The small nuclei (Aitken) mode particles grow rapidly by coagulation into the next largest size mode. The middle size (accumulation) mode particles (0.1-2.5 μ m) are formed mainly by coagulation of and vapor condensation on the nuclei mode particles.

The largest coarse size mode particles (>2.5 μ m) generally make up most of the mass and include particles formed by anthropogenic processes and reentrained surface dust. The two smaller size modes make up what is generally referred to as fine particulate, and the largest size mode is coarse particulate.

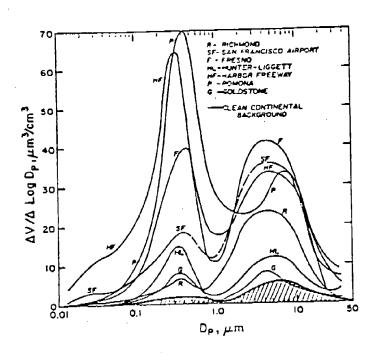


Figure 1. Average volume size distribution for seven sites in the California ACHEX study in 1972 (Whitby 1980).

These two classes, fine and coarse particulates, have different sources and behave independently in the atmosphere. Fine particles mainly result from combustion processes, including the condensation and atmospheric transformation of exhaust gases to form PM. Mechanical processes and wind erosion produce coarse particles. Figure 2 summarizes the principal differences in size and composition of the two types of particles. Fine particles typically consist of sulfates, nitrates, carbonaceous organics, ammonium, and lead. Coarse particles typically consist of oxides of silicon, iron, aluminum, sea salt, tire particles, and plant particles.

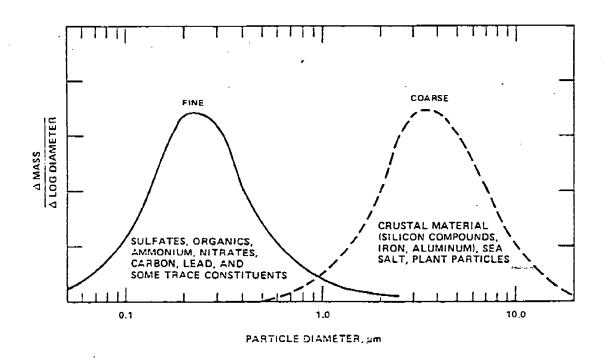


Figure 2. Idealized time and coarse particle mass and chemical composition (U.S. Environmental Protection Agency 1981b).

Both manmade and natural sources emit atmospheric PM. Natural sources in the United States emit about 84 million metric tons annually, while manmade sources emit 125 to 383 million metric tons annually. Dust, sea spray, wild fires, biogenic emanations, and volcanoes are the principal natural sources. Most of the manmade emissions are fugitives from roads (unpaved and paved), construction activities, agricultural tilling, mining activities, and industrial processes. The emissions are estimated using approximations. Reliable estimates of particle emissions from the combustion of fuel and well-defined sources are also available (see Table 1), but these are estimated to include only about 10 percent of the total manmade emissions. However, almost all of these manmade emissions are fine particles, while the natural and fugitive emissions are coarse particles, of which 50 percent or less are smaller than $10~\mu m$. Most of the sources of coarse particles exist in rural areas where population densities are low.

TABLE 1. NATIONAL ESTIMATES OF PARTICULATE EMISSIONS (10⁶ metric tons per year) (EPA 1981b)

	<u>.</u>					
Source category	1940	1950	1960	1970	1975	1978
Stationary fuel combustion	8.7	8.1	6.7	7.2	5.1	3.8
Industrial processes	9.9	12.6	14.1	12.8	7.4	6.2
Solid waste disposal	0.5	0.7	0.9	1.1	0.5	0.5
Transportation	0.5	1.1	0.6	1.1	1.0	1.3
Miscellaneous	5.2	3.7	3.3	1.0	0.6	0.7
TOTAL .	24.8	26.2	25.6	23.2	14.6	12.5

The height of release of emissions can have an important bearing on human health. For example, emissions from motor vehicles and home heating in densely populated areas may be as important as emissions from large stationary sources in remote areas. Both types of sources must be taken into account in assessing monitoring sites.

INSTRUMENTATION

Until a sufficient data base is developed for PM_{10} measurements, most of the information that is available to indicate the nature of particulate matter concentrations will be based on TSP measurements made with high-volume (hi-vol) monitors. Therefore, it is important to understand what hi-vols measure and how this differs from what PM_{10} monitors measure. In addition, the advantages and limitations of instruments that use optical reflectance and beta attenuation need to be understood.

Hi-Vol TSP Monitors

The hi-vol sampler collects particles on a glass-fiber filter. Air is drawn through the filter at a relatively high flow rate (approximately $1.5~\text{m}^3/\text{min}$). Although the collection efficiency for larger (>10 μm) particles is sensitive to wind speed, hi-vols collect essentially all particles less than $25~\mu\text{m}$ under most conditions. The AED of particles with a 50 percent collection efficiency varies from 25 to 30 μm . However, day-to-day variations in wind speed account for no more than a 10 percent variability in measured

concentrations (EPA 1981b). Under identical meteorological conditions, a typical coefficient of variation is 3 to 5 percent. A more significant problem is the formation of artifact mass caused by the reaction of acid gases with material collected on the glass-fiber filter during a 24-hour sample collection. An estimated 6 to 7 $\mu \rm g/m^3$ can be added to a 24-hour concentration measurement by artifacts. Errors may also occur due to loss of volatile particles, deposition on filters before and after sampling, gas reactions after sampling, and filter handling.

Potential Reference Method for PM₁₀

The reference method for PM_{10} is designed to measure that portion of suspended particulate matter in the atmosphere that is likely to be deposited in the thoracic region of the human respiratory tract. The PM_{10} reference method has a collection efficiency of 50 percent for particles with 10 μ AED (i.e., D_{50} = 10 μ m). The measurement consists of drawing air at a constant rate through a specially shaped inlet that inertially separates particles larger than 10 μ from the sampling stream. The effectiveness of the size discrimination for the 10 μ separation must match the prescribed limits defined by the reference method, or not differ by more than 10 percent in the expected mass concentration measured by a sampler with the ideal size cut efficiencies. The particles contained in each sampling stream are collected on a filter that is weighed (after moisture equilibration) before and after sampling. As with hi-vol sampling, the volume of air sampled is also measured and corrected to EPA reference conditions (i.e., 25° C and 760 mm Hg).

Although the median particle size collection efficiency is the principal characteristic of a PM_{10} reference method sampler, a sampler must also meet the following criteria to be a reference method:

- The particle size above which the collection efficiency is less than 50 percent must be within 1 μ m of 10 μ m.
- The concentration measurements must be reproducible with 15 percent precision.
- The flow rate must be stable to within 10 percent of the initial flow rate over a 24-hour period.

The specific requirements of a \mbox{PM}_{10} reference method are given in Appendix J of 40 CFR 50.

 $^{^{1}}$ The particle size cut, D₅₀, of a PM sampler is defined as the particle diameter at which the collection efficiency is less than 50 percent for all larger particles.

PM₁₀ samplers are subject to errors due to loss of volatile particles, artifact PM, nonsampled PM deposition, humidity, filter handling, flow rate variations, and air volume determinations. However, the uncertainties associated with gravimetric measures of particulate matter are less than those associated with particulate measurements based on other principles.

Other Particulate Matter Measurements

The gravimetric method of measuring PM is limited by the need to (1) accumulate an adequate mass for detection by use of an analytical balance, (2) condition the filter for moisture content, (3) separate the collection time from the mass assessment time, and (4) handle the sample between collection and assessment. To eliminate these disadvantages, optical sensing and beta attenuation measurement principles can be used. However, measurements based on these principles do not measure mass directly and may produce variable concentration estimates when certain properties of the particles vary (e.g., particle size distribution or carbon content).

A commonly used instrument based on optical sensing is the tape sampler. Particles are collected to form a stain on a paper tape filter, which is periodically advanced. The transmittance of light through the stain is measured to determine the optical density or coefficient of haze (COHS). The COHS units at a given site may be calibrated to mass measurements made with a colocated gravimetric device. The tape sample is capable of finer time resolution and faster readout time than gravimetric sensing methods. For certain purposes, including response to severe pollution buildups that require a rapid update of information, optical sensing may be a necessary alternative to gravimetric sensing.

It is also possible to measure specific properties of collected samples. Such properties may include sulfate and nitrate components, visibility reduction, and specific elemental components. The need for information other than mass concentration of PM should be defined when monitoring operations are planned and factored into siting considerations. Samples taken for mass concentration measurements usually can be used for other purposes, because the mass measurement techniques preserve the samples.

USE OF AVAILABLE DATA TO DRAW INFERENCES ABOUT ${ t PM}_{10}$ LEVELS

Because of the abundance of TSP data and the limited quantity of PM_{10} data available, it may be necessary to use TSP or other available measures of PM to determine expected patterns of PM_{10} . EPA has published a document examining relations of PM_{10} to other particulate matter (Procedure for Estimating Probability of Nonattainment of PM_{10} NAAQS Using TSP or PM_{10} Data). The details of this procedure are beyond the scope of this document; however, a few conclusions from this report are provided.

The ratio of PM $_{10}$ /TSP was examined at sites consisting of collocated PM $_{10}$ /TSP sites operating in 1982 and 1983 for the purpose of establishing a simple ratio which would permit the direct adjustment of TSP to PM $_{10}$. However, upon scrutinizing the data base, it was clear that a substantial degree of variability existed amongst individual ratios. (The IP/TSP ratios were also examined, only to

establish that they confirmed the PM10/TSP analyses.) This variability includes inter- as well as intrasite differences in the ratios. As described elsewhere in the document, the PM10/TSP ratio was also found to be somewhat sensitive to TSP concentrations. This sensitivity is diminished by focusing on site-days observing TSP \geq 100 ug/m³ or, in the case of annual analyses, site-years with TSP \geq 55 ug/m³.

Several attempts were also made to find an explanatory site descriptor which could account for the disparity in the ratios among sites (i.e., inter-site variability). In the first attempt, such site descriptors as urban versus suburban were compared; however, no statistically significant difference was found. Geographic area (East, Southwest, West Coast, etc.) and site type (industrial, commercial or residential) likewise revealed insignificant differences in the ratios. In a more recent and more extensive investigation of geographic differences performed on the entire 1982 and 1983 data base, statistically significant differences were found among individual sites as well as among larger groupings of sites. However, the differences among larger groupings of sites are smaller and are difficult to explain on a physical basis. These investigations conclude that—unless sufficient data to calculate a site specific PM10/TSP ratio are available, the existing data base does not justify use of different distributions of ratios for different parts of the country.

The previously described investigations of geographic, climatological, concentration range, or site type classifiers were attempts to reduce or account for part of the variability in PM10 to TSP ratios. No doubt, a part of the overall variance in ratios results from intra-site variation in ratios arising from differences in the sources impacting the monitor site. As discussed in other sections of the document, there are several issues associated with the precision of the TSP and PM10 measurements which affect intra-site variance. These factors include windspeed dependence, weighing problems, artifact formation and sampler wall losses. Thus, the inter-site variance can potentially be eliminated by the use of site specific data, but the intra-site variance can only be partially reduced by careful operating procedures.

The variance among PM $_{10}$ /TSP ratios suggests the need to examine the frequency distribution of ratios rather than relying on a single value for the ratio. The cumulative frequency distribution for PM $_{10}$ /TSP is presented in Figure 3 for site average (arithmetic mean) ratios. Figure 4 contains a similar distribution

SPATIAL/TEMPORAL PATTERNS

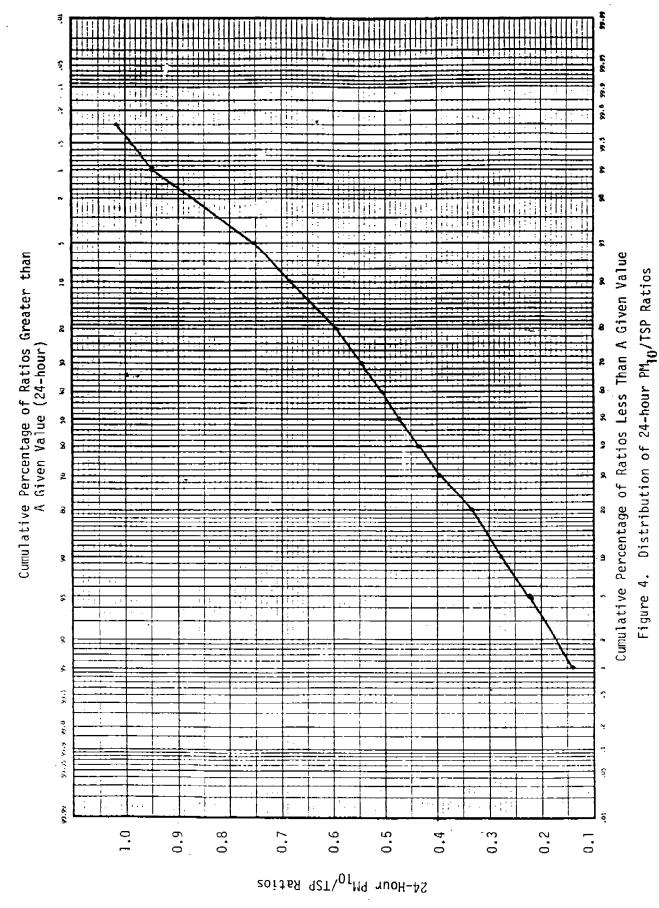
National spatial and temporal patterns of PM_{10} have been deduced from a variety of available PM observations. Sections 3 and 4 of this document contain guidelines for estimating these patterns in local areas. Important factors that influence the patterns are the sources of emissions, topography and other physiographic factors, and meteorology. Figure 5 shows an indication of the variation in concentrations that can be expected with season of the year and with rural, suburban, and urban location. These graphs are based on monitoring data from a small number of sites.

ş Cumulative Percentage of Ratios Less Than A Given Value (Annual) Given Value (Annual) 2 3 3 2 3 ŝ 3 ā. 11.7 13.14 0.8 9.0 0.5 0.3 6.0 0.4 0.2 0.1 0.7 Annual PM₁₀/TSP Ratios

Figure 3. Distribution of Annual $\rm PM_{10}/TSP\ Ratios$

Cumulative Percentage of Ratios Greater Than a

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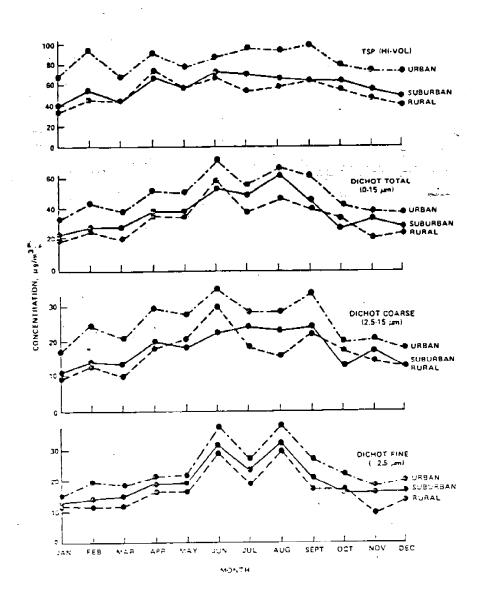


Figure 5. Seasonal variations in urban, suburban, and rural areas for four size ranges of particles.

Source: After Trijonis et al. (1980).

Influence of Sources

The highest TSP values are found in dusty arid regions and in industrialized cities. Table 2 shows a breakdown of the principal categories of sources that comprise the EPA national inventory of particulate emissions. The much larger fugitive emissions from nonindustrial anthropogenic activities, such as travel on unpaved roads and wind-eroded farmland, are not included in these figures. These indirect fugitive emissions are coarse particles, and less than 50 percent of their mass will be less than 10 um in diameter. Furthermore, the sources are widely dispersed and not concentrated near populated areas.

Most of the interest in controlling and monitoring particulate emissions focuses on the stationary sources listed in Table 2. These emissions are believed to contain more toxic elements and to consist primarily of fine particles. Fugitive dust emissions from stationary sources are of particular concern, because they exceed stack emissions, are emitted near ground level, and contain more toxic materials than soils from farmlands and unpaved roads away from industrial sources.

Influence of Atmospheric Processes

PM emitted into the atmosphere is transported by the wind and diluted by various atmospheric turbulence and mixing processes. In addition, particles are removed by dry and wet deposition processes. Particles remaining airborne may grow by condensation, coagulation, and chemical reactions; these growth processes are enhanced by the accumulation of moisture. Figure 6 summarizes and graphically illustrates many of these various atmospheric processes.

Secondary pollutants, which form and grow due to these atmospheric processes, are a major component of PM concentrations. Sulfates, formed primarily by atmospheric reactions, often account for 40 percent of the fine particles. Because fine particles typically contribute about one-third of TSP mass and because PM_{10} is expected to equal about 50 percent of the TSP levels, it is reasonable to expect the sulfate contribution to equal about 25 percent of PM_{10} measurements. But on many occasions the total contribution of secondary PM to PM₁₀ measurements may be considerably higher than 25 percent. Because the formation of secondary PM requires time, the principal sources are likely to be remote from the point where they are measured. This makes it important to measure PM10 concentrations upwind of urban areas, as well as within and downwind of the areas of concern. The formation of sulfates and nitrates is sufficiently active in both summer and winter to produce high contributions to PM10 measurements. The formation of organic aerosols is also important; observed 24-hour concentrations have reached as high as 100 µg/m^3 .

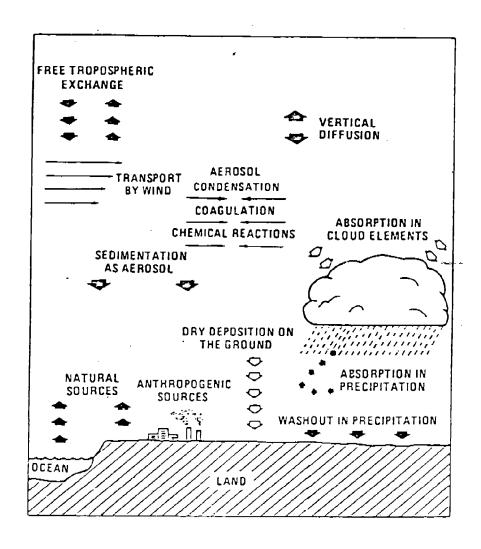
TABLE 2. SUMARY OF NATIONAL 1985 PARTICULATE MATTER EMISSIONS BY SOURCE CATEGORY (EPA 1987)

Source Category	1985 Emissions (10 ³ tons)		
Coal-fired electric utility boilers	627		
Coal-fired industrial boilers	132		
Integrated iron and steel plants and coke ovens*	187		
Portland cement plants	286		
Primary nonferrous smelters#	44		
Solid waste disposal plants	110		
Kraft Pulp and paper mills	110		
Asphalt batching plants	132		
Concrete lime and gypsum	99		
Iron and steel foundries	44		
Subtotal for selected source categories	1771		
Stationary sources§	6600		
Mobile sources	1430		
All sources	8030		

^{*} Includes emissions from materials handling and storage piles.

 $^{^{\}sharp}$ Includes fugitive process emissions and emissions from ore crushing and materials handling.

[§] By difference between all sources and mobile sources.



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Figure 6. Complex processes affecting transport and transformation of airborne particulate matter.

Source: Adapted from Drake and Barrager (1979).

SECTION 3

MONITORING OBJECTIVES FOR PM10

Two pressing questions arise in planning a monitoring program. How many monitors are required? And where should they be located? The answers affect the allocation of resources that, particularly in operational settings, ultimately shape the final program.

Due to a wide diversity of topography, population distribution, source locations, and climates, ambient air quality monitoring regulations and policies rarely specify the number and location of monitors. But regardless of the influence of physical factors, the specifications for a monitoring network strongly depend upon the monitoring objectives.

A monitoring objective relates the monitoring mandate to spatial/temporal variations in sources of pollution, meteorology, and receptors of pollution. The monitoring mandate arises from specific needs and uses for data. A monitoring objective is the link between the goals of the mandate and appropriate siting opportunities in the monitoring scene. Monitoring objectives relate program objectives that concentrate upon end uses for the collected data and physical objectives that concentrate on the temporal and spatial character of representative sampling.

One obvious use of PM_{10} data lies in establishing environmental regulations and policies. Such regulatory mandates are rooted in the Clean Air Act (CAA) and other Federal, state, and local regulations that specify air quality requirements.

Other data uses satisfy research needs and support public services. A variety of data uses for the criteria pollutants have been summarized in other EPA monitoring guidelines (Ball and Anderson 1977; Ludwig and Kealoha 1975; Ludwig, Kealoha, and Shelar 1977; Ludwig and Shelar 1978) and elsewhere (e.g., EPA 1977a). Table 3 summarizes these varied data uses:

- Evaluation of ambient air quality
- Enforcement of source-specific regulations
- Evaluation/development of control plans
- Air quality maintenance planning
- Protection of public health
- Development and testing of models
- Research.

TABLE 3. PRINCIPAL DATA USES FOR PM10

- Evaluation of Ambient Air Quality
 - Judging Attainment of NAAQS
 - Establishing Progress in Achieving/Maintaining NAAQS
 - Establishing Long-Term Trends
- 2. Enforcement of Source-Specific Regulations
 - Categorical Sources (ESECA, SCS, PSD)
 - Individual Sources
 - Enforcement Actions
- 3. Evaluation/Development of Control Plans
 - SIP Provisions
 - Evaluation/Development/Revision of Local Control Strategies
- 4. Air Quality Maintenance Planning
 - Establishing Baseline Conditions
 - Project Future Air Quality
- 5. Protection of Public Health
 - Air Quality Indices
 - Documentation of Population Exposures
 - Response to Unique Citizen Complaints
 - Development/Revision of Standards
- 6. Development and Testing of Models
 - Input for Receptor Models
 - Validation and Refinement
 - Assessing Representativeness of Monitoring Networks
- 7. Research
 - . Effects on Humans, Plants, Animals and Environment
 - Characterization of Source, Transport, Transformation, and Fate for Anthropogenic and Natural Emissions
 - Development/Testing of New Instrumentation

The order of the listed uses does not represent any sense of priority. The uses are a composite of diverse program objectives that would require extended discussion to develop in detail.

In all areas except research, a straightforward relationship exists between mandate and program objectives or data uses. Thus these representative data uses provide a range of example situations, so that physical objectives for specific cases not covered here can be developed by analogy.

EVALUATION OF AMBIENT AIR QUALITY

The National Ambient Air Quality Standard for PM_{10} stipulates acceptable air quality in terms of a 24-hour criteria level (not to be exceeded more than the specified number of times a year) and an annual criteria level (the 12-month arithmetic mean). Although the NAAQS is the principal standard that must be met, other local and state agencies may set standards that must be met.

Compliance with the NAAQS is a fundamental goal of ambient air quality control strategies (particularly for State Implementation Plans (SIPs)) and forms the basis for air quality maintenance planning, policy development, and additional regulation. Data are needed to evaluate ambient air quality and detect compliance with the NAAQS. Attainment status is conferred upon an area, based on the expectation that the NAAQS criteria levels are not violated. Therefore, the monitoring objectives are geared to acquiring measurements that represent conditions throughout the area in question, the underlying context being that air quality levels elsewhere in the area are no worse than those indicated by the measurements.

The data are also used to demonstrate reasonable progress toward attainment for areas in violation of the NAAQS, document baseline conditions for environmentally sound expansion and development, and depict long-term trends.

ENFORCEMENT OF SOURCE-SPECIFIC REGULATIONS

Under some circumstances, major air pollution sources are allowed to operate under demonstration that their emissions do not cause ground-level concentrations that exceed a specified criteria level. The criteria level is ordinarily tied to NAAQS, but may be tied to other criteria. These situations may prevail for power plants, coking facilities, and other categorical sources under a variety of regulations. Source-specific regulations may consist of tailored or negotiated agreements that are integrated to implementation plans on a source-by-source basis. Although the responsibility to monitor may fall upon a regulatory agency or upon the source management, the objective is to measure the impact of a known source.

Indications of compliance/noncompliance are often used in enforcement proceedings and frequently form the basis for litigation and negotiation. A corollary monitoring situation entails isolating an offending source or family of sources when an adverse impact is measured.

Many applications require a long-term, continuing monitoring program. However, in some enforcement situations, a relatively short sampling program or a periodic survey approach is applicable.

EVALUATION/DEVELOPMENT OF CONTROL PLANS

Government monitoring agencies and pollution source operators are actively concerned with gaining/retaining NAAQS attainment status. Procedures for pursuing this goal are stated in the SIP, which is expanded and modified as needed.

Monitoring data are needed for the following purposes:

- Define nonattainment areas
- Develop control policies and strategies
- Define nondeterioration areas
- Develop air pollution emergency episode plans.

The monitoring data are used to demonstrate and characterize the need for controls. The demonstration may identify categorical sources or specific sources. Nondeterioration areas and areas subject to growth or economic rejuvenation require monitoring to define the baseline conditions.

Monitoring data are needed in areas subject to extremely high concentrations to identify the onset and abatement of episodes. A separate guidance document on the timely reporting of ${\rm PM}_{10}$ concentrations during emergency episodes is available (EPA 1983).

AIR QUALITY MAINTENANCE PLANNING

Planning agencies and developers from the private sector require monitoring data to determine baseline air quality levels in locations of projected growth and expansion. These data may be critical in determining whether such activity will meet Prevention of Significant Deterioration (PSD) requirements in attainment areas or interfere with progress toward attainment of NAAQS in nonattainment areas. Siting considerations need to consider whether special sites are needed to meet these data needs or whether the nearest available monitoring will be adequate.

PROTECTION OF PUBLIC HEALTH

It can be argued that all air quality monitoring is ultimately oriented to public health. Air quality indices keep the public appraised of current levels of air pollutants. The siting requirements to meet the data use need to be coordinated with needs for emergency episode data and for ambient air quality evaluations. A second category of public health oriented data use involves documentation of population exposures. This may require a specially sited network designed to estimate personal exposures in connection with epidemiological studies. Special monitoring sites may also be required to respond to unique citizen complaints. These frequently involve sources and impacts that are not part of operational coverage.

DEVELOPMENT AND TESTING OF MODELS

Monitoring requirements to support model development or testing are generally unique for each project. This is particularly true for model development support where the objective is to describe and understand the ongoing processes or to develop parameter values representative of a specific terrain, meteorological condition, or source configuration. As a general rule, monitoring for model development must be intensive and flexible to provide the maximum benefit. Measurements are desired that are as tightly spaced and as frequently recorded as are compatible with economic restraints. However, the monitoring equipment should be mobile enough so that it can be moved as conditions change or as analyzed information indicates a need for information from different locations.

The primary emphasis is on demonstrating that the model being tested adequately estimates the highest concentrations. This means that monitoring data needs to be taken at locations downwind of major sources during critical meteorological conditions. The data record needs to be sufficiently long to truly characterize the data site—usually a minimum of 1 year—if the model is to demonstrate validity at the test site. Test data, preferably from a different locality, must be independent of data used to develop the model. The placement and number of monitors will depend on meteorological conditions, topography, source characteristics, and purpose of the model. Sections 4 and 5 of this report provide further suggestions with respect to these influences.

RESEARCH

Monitoring data is needed to support research allied to PM_{10} questions in order to improve the scientific tools for measurement, interpretation, and prediction. Monitoring sites selected to support research may coincide or

supplement other monitoring requirements. Research needs in the following areas may be considered when selecting sites:

- 1. Effects on humans, plants, animals, and environment
- 2. Characterization of source, transport, transformation, and fate for natural and anthropogenic emissions
- 3. Development and testing of new instrumentation.

SECTION 4

ELEMENTS OF SITE SELECTION

The site selection procedures offered in Section 5 rely primarily on inferred and demonstrated associations among PM_{10} sources, meteorology, and a number of physical factors such as topography and land use. Important outcomes (i.e., ambient concentrations) can vary tremendously from place to place within a monitoring scene and from time to time at a given place. From a useful perspective, any area to be monitored is going to be too complex to bring all structures into focus at once. The concept of representative scale is a useful way to characterize these variations on a physical basis that can be related to comprehensible patterns.

REPRESENTATIVE SCALES

The concept of representative spatial scale is used to define a characteristic distance over which pollutant concentrations are uniform or mearly so. As a corollary, we can define homogeneous areas in which measurements performed in the relatively small air volume near a sampler (nominal horizontal extent of 1 meter) can represent conditions prevailing over some much larger area.

Representative spatial scales illustrated in Figure 7 have been previously identified (EPA 1979) and are compatible with spatial scales of source areas. We shall be concerned with the following spatial scales:

- Microscale--ambient air volumes ranging in horizontal extent from a few meters to as much as 100 m. The microscale encompasses the immediate vicinity of the monitor. In the immediate presence of PM₁₀ sources, exposure may in reality be only representative of the microscale. For this reason, the microscale is the final judgmental factor in site selection (see Section 5) and requires a site visit to make this appraisal, because maps rarely portray confounding influences in sufficient detail.
- Middle scale--ambient air volumes covering areas larger than microscale but generally no more than 0.5 km in extent. In settled areas, this may amount to several city blocks. As will be shown later, this is essentially the lower limit of resolution for most models.
- Neighborhood scale--ambient air volumes whose horizontal extent is generally between 0.5 and 4 km. The neighborhood scale is aptly named. It is useful in defining extended areas of homogeneous land use.

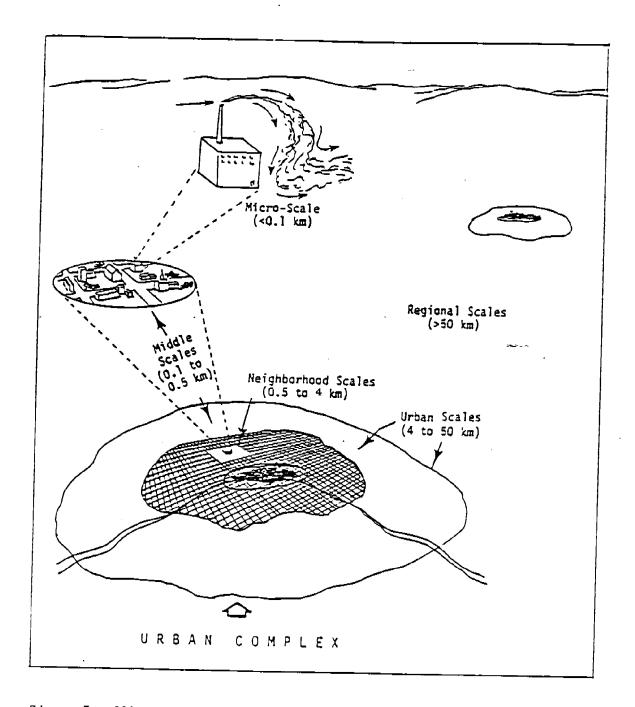


Figure 7. Illustration of various spatial scales of representativeness (Ball and Andersen 1977).

- Urban scale--ambient air volumes whose horizontal extent
 may range between 4 and 50 km. This is frequently the
 most desirable representative spatial scale, because
 it captures an entire urban area. However, the diversity
 of sources that prevail within such areas argue against
 homogeneity at this scale.
- Regional scale—ambient air volumes whose horizontal extent ranges from tens of kilometers to hundreds of kilometers. Monitors that are unaffected by specific sources or by localized groups of sources can be representative at this scale.
- National and global scales—seek to characterize air quality from a national perspective (thousands of kilometers) or from a global perspective (tens of thousands of kilometers).

Although all of the above scale intervals may be needed to subdivide a monitoring scene, the neighborhood scale in urban settings and the regional scale in substantially unsettled areas are particularly practical scales for spatial coverage by a single monitor. In many circumstances, the representativeness of the small scales must be estimated by networks composed of a limited number of sites.

ANALYSIS OF THE AREA TO BE MONITORED

The primary intent of the analytical process that supports site selection is to characterize pollutant levels within the area to be monitored. This requires information regarding the location of important sources of PM_{10} , a description of atmospheric trajectories to trace the movement of PM_{10} , and estimates of dispersion accompanying such movement. These reflect a complex interplay among topography and climatology that must be cast into time frames that are compatible with the NAAQS. Three components for analysis are as follows:

- Regional dispersion climatology—to assemble the basis for transport/dispersion patterns that may be applied to the area to be monitored as a whole
- Physical differentiation—to assemble the basis for identifying distortions of simple source/ receptor relationships due to local alterations of trajectory and dispersion
- Emissions configuration—to assemble the basis for identifying relevant PM₁₀ sources and recognizing useful patterns.

An area of interest with respect to air quality is usually defined by political boundaries, such as state, county, city, or air quality control region lines. A method of systematically characterizing the area to be monitored into homogeneous areas of air quality levels that are potential locations of air pollution monitoring sites requires that sources of particulate emissions, patterns of terrain and physiography, and climatology be taken into account. A method and data sources for performing such a classification analysis for ambient concentrations of PM have been developed in this study beginning with a description of the three categories of influencing factors. The methodology is presented in Section 5.

Emissions Configuration

The emissions configuration is simply the spatial/temporal distribution of sources throughout the monitoring scene; in concept, it will consist of one or more maps delineating areas of similar source characteristics. Depending on the mix of sources and local/regional climate, such maps will depict relevant seasonal and diurnal emissions patterns in terms of relative intensities and release heights.

In concept, the most straightforward approach to generating maps would be to selectively allocate the elements of a formal emissions inventory to a suitably detailed grid. In practice, this is not a trivial task; even an automated approach carries a substantial burden in data management and manipulation. Though difficult, this approach has merit because it develops highly usable data for subsequent computerized modeling.

An alternative approach is to proxy these source areas by patterns of land use. In most urban areas, planning agencies have compiled information that can form the basis for categories of near-surface emission. In the absence of such information, relatively unsophisticated interpretation of aerial photographs can be helpful. Table 4 offers a land use classification that is amenable to this approach. Emission factors can be assigned to each land use classification based on consideration of local heating fuels, climate, and census data in housing and population densities. In addition, large point sources (e.g., 1000 tons per year) should be separately identified.

The first use of an emissions configuration is in a semiquantitative or subjective mode. The orientation of key impact zones can be surmised with the aid of appropriate wind roses. Areas likely to be inundated by several sources can be identified.

An emissions inventory provides important information to the site selection process by identifying significant point and area sources and cataloging emissions in terms of location, source strength, operating characteristics, etc. The National Emissions Data System (NEDS), for instance, identifies individual point sources that release 100 tons per year or more

TABLE 4. IDENTIFICATION AND CLASSIFICATION OF LAND USE TYPES (AFTER AUER 1978)

Type	Use and structures	Vegetation
Ī1	Heavy Industrial	
	Major chemical, steel, and fabrication industries; generally 3- to 5-story buildings, flat roofs	Grass and tree growth extremely rare; <5% vegetation
12	Light-Moderate Industrial	
	Rail yards, truck depots, warehouses, industrial parks, minor fabrications; generally 1- to 3-story buildings, flat roofs	Very limited grass, trees almost totally absent; <5% vegetation
C1	Commercial	
	Office and apartment buildings, hotels; >10-story heights, flat roofs	Limited grass and trees; <15% vegetation
R1	Common Residential	
	Single-family dwelling with normal easements; generally single-story, pitched-roof structures; frequent driveways	Abundant grass lawns and light to moderately wooded; >70% vegetation
R2	Compact Residential	planting on the
	Single- and some multiple-family dwellings with close spacing; generally <2-story, pitched-roof structures; garages (via alley), no driveways	Limited lawn sizes and shade trees; <30% vegetation
R3	Compact Residential	
	Old multifamily dwellings with close (<2 m) lateral separation; generally 2-story, flat- roof structures; garages (via alley) and ashpits; no driveways	Limited lawn sizes, old estab- lished shade trees; <35% vege- tation
₹4	Estate Residential	
	Expansive family dwelling on multiacre tracts	Abundant grass lawns and lightly wooded; >95% vegetation
41	Metropolitan Natural	
	Major municipal, state, or Federal parks, golf courses, cemeteries, campuses; occasional single-story structures	Nearly total grass and lightly wooded; >95% vegetation
42	Agricultural Rural .	Local crops (e.g., corn, soybeans); >95% vegetation
A3	Undeveloped	
	Incultivated; wasteland	Mostly wild grasses and weeds, lightly wooded; >90% vegetation

of five criteria emissions (particulate matter, ${\rm SO}_{\rm X}$, ${\rm NO}_{\rm X}$, ${\rm CO}$, hydrocarbons) as well as area sources aggregated at the county level (i.e., all other stationary sources that individually emit less than 100 tons per year and all mobile sources). More detailed approaches (e.g., Pace 1979) develop microinventories that add perspective and structure to the area source category.

It is beyond the intended scope of this report to promote methodologies for constructing emission inventories. For the purposes at hand, an emissions inventory for particulate matter emissions is assumed to be available and ready for use. Such an inventory may be composed of NEDSbased data (EPA 1984) or may have been specially constructed for the monitor siting analysis.

During the last few years EPA has had PM_{10} emission factors developed for a large number of source categories. The development of PM_{10} emission factors for additional source categories including some fugitive and open sources is still in progress at this time. The user is referred to EPA's Compilation of Air Pollution Emission Factors AP-42 for specific emissions by source category and specific methodology for their use in developing emission estimates. The compilation provides specific factors not only by general source category but also for each processing step within a category. Tables 5 and 6 present example emission factors for some selected source categories. These examples have been taken from EPA's report.

Terrain and Physiography

The patterns of ambient concentrations that occur due to the transport and diffusion of pollutants over open and flat terrain are significantly distorted by irregularities in the terrain and other features of physiography. Two major factors in this regard are as follows:

- Aerodynamic diversion—flow around and over obstacles.
 Distortion of the flow field may be severe during moderate to strong synoptic winds.
- Local circulations—mountain-valley winds, land—sea breezes, and the like that may prevail when synoptic influences are sufficiently weak. Under these conditions, flow patterns within the scene may "wall off" subareas. Transport and dispersion estimates at one place are unlikely to reflect air motions elsewhere.

TABLE 5. CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE SPECIFIC EMISSION FACTORS FOR SPREADER STOKERS BURNING BITUMINOUS COAL®

EMISSION FACTOR RATING: C (uncontrolled and controlled for multiple cyclone without flyash reinjection, and with baghouse) E (multiple cyclone controlled with flyash reinjection, and ESP controlled)

Particle dias : (we)	Cumulative mone 3 ≤ stated elice					Completive aggeston factor [kg/kg (lb/ton) coal, so fired]				
	Uncontrolled	Controlled			Uncontrolled	Controlled				
		Mulciple cycloned	E57	Baghouse		Multiple cyclone ^c	Multiple cyclone	ESP	Baghouse	
15	25	86	74	97	72	8,4 (16.8)	7,3 (14-6)	4.A (8.8)	0.23 (0.46)	0.043 (0.086)
10	20	73	65	90	60	6.0 (12.0)	4.2 (12.4)	3.9 (7.8)	0.22 (0.44)	0.034 (0.072)
•	14	51	32	82	44	4.2 (8.4)	4.3	3.1 (6.2)	0.20 (0.40)	- 0.028 (0.056)
2.5	,	6	27	61	26	2.1 (4.2)	0.7 (1.4)	1.6 (3-2)	0.15 (0.30)	0.016 (0.032)
1.25	5	2	16	46	14	(3.0)	0.2 (0.4)	1.0 (2.0)	0.11 (0.22)	0.011 (0.022)
1.00	5	2	14	41	15	1.3 (3.0)	0.2 (0.4)	0.8 (1.6)	0.10 (0.20)	0.009 (0.018)
0.625	•		,	•	,	1.2	0.1 (0.2)	0.5 (1.0)	•	0.004
TOTAL	100	100	100	100	100	30.0	1.5	6.0	0.24 (0.48)	0.06

Reference 61. ESP - electrostatic precipitator.

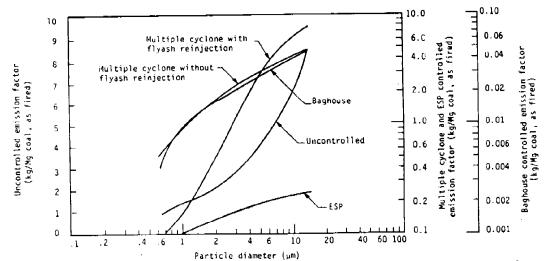
bExpressed as aerodynamic equivalent disseter.

CWith flyash reinjection,

dWithout flyash reinjection,

electrostatic data.

fEstimated control efficiency for ESP, 99.2%; baghouse, 99.8%.



Cumulative size specific emission factors for spreader stokers burning bituminous coal

TABLE 5 (continued): CUMULATIVE PARTICLE SIZE DISTRIBUTION AND SIZE SPECIFIC EMISSION FACTORS FOR DRY BOTTOM BOILERS BURNING PULVERIZED BITUMINOUS COAL

EMISSION FACTOR RATING:

C (uncontrolled)

D (scrubber and ESP controlled

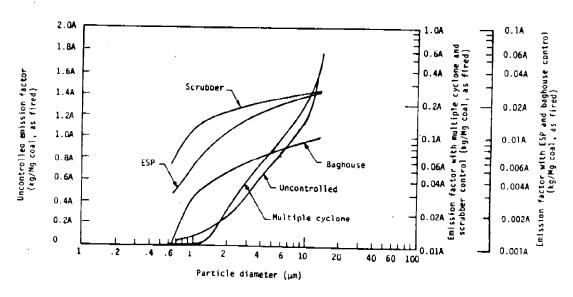
E (multiple cyclone and baghouse)

Particla size ^b (um)	Cumulative made 2 < stated size					Completive emission factor [kg/Ng (lb/ton) cosl, as fired]					
	Uncontrolled	Controlled			Uncontrolled	Controlled ^d					
		Multiple cyclone	Scrubber	723	Beghouse		Heltiple cyclone	Scrubber	2.SF	Baghouse	
L5	32	54	81	79	97	1.6A (3.2A)	0.54A (1-08A)	0-24A (0-48A)	0.032A (0.06A)	0.010A (0.02A)	
10	23	29	71	67	92	1-154 (2-3A)	0.29A (0.58A)	0-21A (0-42A)	0.027A (0.05A)	0.009A (0.02A)	
6	17	14	62	50	77	0.65A (1.7A)	0-14A (0-28A)	0.19A (0.38A)	0.020A (0.04A)	0-008A (0-02A)	
2.5	•	3	51	29	53	0.30A (0.6A)	0.03A (0.06A)	0.15A (0.3A)	0.012A (0.02A)	0.005A (A10.0)	
1-25	2	1	35	17	31	0.10A (0.2A)	0.01A (0.02A)	0.11A (0.22A)	0.007A (0.01A)	0.003A (0.006A)	
1.00	2	1	31	14	25	0-10A (0-2A)	0.01A (0.02A)	0-09A (0-18A)	0-006A (0-01A)	0.003A (A200.0)	
0-625	1	1	20	12	14	0.05A (0.10)	0-01A (0-02A)	0.06A (0.12A)	0-005A (0-01A)	0.001A (0.002A)	
TOTAL	100	100	100	100	100	5 <u>A</u> (10 <u>A</u>)	IA (2A)	0.3A (0.6A)	0.04A (0.08A)	0.01A (0.02A)	

bEspressed as caredyonaic equivalent diameter.

CA = coal ash weight I, as fired.

dEstimated control efficiency for multiple cyclone, 80I; scrubber, 94I;
ESP, 99.2I; baghouse, 99.8I.



Cumulative size specific emission factors for dry bottom boilers burning pulverized bituminous coal.

EMISSION FACTORS

TABLE 6. SIZE SPECIFIC EMISSION FACTORS FOR COKE MANUFACTURING

	Particulate emission	Particle size (µm)	Cumulative mass X	Cumulative mass emission factors		
Process	factor rating		≤ stated size	kg/Mg	1b/ton	
Coal preheating Uncontrolled	D	0.5 1.0 2.0 2.5 5.0 10.0	44 48.5 55 59.5 79.5 97.5 97.9	0.8 0.8 1.0 1.0 1.4 1.7	1.5 1.7 1.9 2.1 2.8 3.4 3.5 3.5	
Controlled with venturi scrubber	D	0.5 1.0 2.0 2.5 5.0 10.0	78 80 83 84 88 94 96.5	0.10 0.10 0.10 0.11 0.11 0.12 0.12	0.20 0.20 0.21 0.21 0.22 0.24 0.24	
Coal charging Sequential or stage	E	0.5 1.0 2.0 2.5 5.0 10.0	13.5 25.2 33.6 39.1 45.8 48.9 49.0	0.001 0.002 0.003 0.003 0.004 0.004 0.004	0.002 0.004 0.005 0.006 0.007 0.008 0.008	
Coke pushing Uncontrolled	D	0.5 1.0 2.0 2.5 5.0 10.0	3.1 7.7 14.8 16.7 26.6 43.3 50.0	0.02 0.04 0.09 0.10 0.15 0.25 0.29	0.04 0.09 0.17 0.19 0.30 0.50 0.58 1.15	
Controlled with Venturi scrubber	D	0.5 1.0 2.0 2.5 5.0 10.0	24 47 66.5 73.5 75 87 92 100	0.02 0.04 0.06 0.07 0.07 0.08 0.08	0.04 0.08 0.12 0.13 0.13 0.16 0.17	

(continued)

TABLE 6 (Continued)

	Particulate emission	Particle	Cumulative mass %		ative mission tors	
Process	factor rating	size (µm)	<pre> stated size</pre>	kg/Mg	1b/ton	
Mobile scrubber car	D	1.0 2.0 2.5 5.0	28.0 29.5 30.0 30.0	0.010 0.011 0.011 0.011	0.022 0.022	
·		10.0 15.0	32.0 35.0 100	0.012 0.013 0.036	0.024 0.023 0.072	f Tango en Ta
Quenching Uncontrolled (dirty water)	D	1.0 2.5 5.0 10.0 15.0	13.8 19.3 21.4 22.8 26.4 100	0.36 0.51 0.56 0.60 0.69 2.62	0.72 1.01 1.12 1.19 1.38 5.24	
Uncontrolled (clean water)	В	1.0 2.5 5.0 10.0 15.0	4.0 11.1 19.1 30.1 37.4 100	0.02 0.06 0.11 0.17 0.21 0.57	0.05 0.13 0.22 0.34 0.42 1.13	
With baffles (dirty water)	D	1.0 2.5 5.0 10.0 15.0	8.5 20.4 24.8 32.3 49.8 100	0.06 0.13 0.16 0.21 0.32 0.65	0.11 0.27 0.32 0.42 0.65 1.30	
With baffles (clean water)	ם	1.0 2.5 5.0 10.0 15.0	1.2 6.0 7.0 9.8 15.1	0.003 0.02 0.02 0.03 0.04 0.27	0.006 0.03 0.04 0.05 0.08 0.54	
Combustion stack Uncontrolled	[.] Д	1.0 2.0 2.5 5.0 10.0 15.0	77.4 85.7 93.5 95.8 95.9 96 100	0.18 0.20 0.22 0.22 0.22 0.22 0.23	0.36 0.40 0.44 0.45 0.45 0.45	

In many instances these factors are of minor influence to site selection, particularly when viewed from the perspective of the 24-hour averaging period that defines most operational PM₁₀ monitoring. More often, however, these influences are severe enough to warrant attention, particularly in source-oriented applications. There are many circumstances where an area may experience aerodynamic diversion problems under moderate to strong synoptic influences while exhibiting local circulations when synoptic conditions are weak. Because of this, discussion of these two factors is structured around the physical aspects of the monitoring scene that should alert the monitoring designer to the situation. Four primary areas for discussion have been identified: topographic influences, coastal settings, small-scale obstacles, and urban effects.

These factors are expressed in varying intensity from area to area. A detailed discussion of resulting patterns is clearly beyond the intended scope of this document. Therefore, each topical area will be treated in summary fashion, and the description will rely heavily upon illustrations.

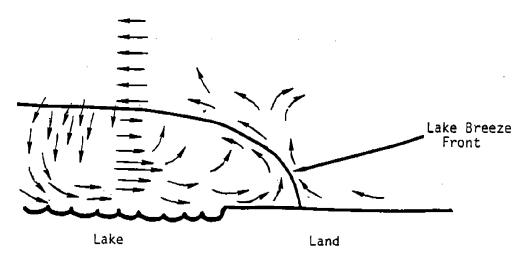
Topographic Influences--

Topographic elements become a factor when their influences extend into the neighborhood scale (horizontal size order of kilometers). Because the ratio of downstream aerodynamic effect to obstacle height is on the size order of 10 to 1, obstacles on the order of 100 m will influence horizontal sizes of the order of 1 km. The central problem that terrain introduces is the added detail impressed upon the advection/dispersion field. That is, a simple pattern that may be replicated consistently throughout a scene of level terrain becomes an inconstant three-dimensional perturbation in the presence of substantial terrain relief. The principal types of flow distortion that occur include separation flow on the downwind side of ridges when the flow is perpendicular to the ridge, channeling of air flow by valleys, and local circulations caused by differential heating of adjacent terrain slopes.

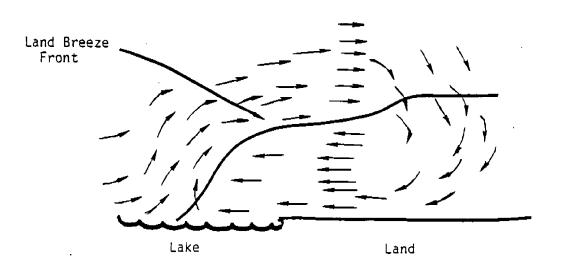
Coastal Settings--

In coastal settings, during periods of light synoptic winds accompanied by a sufficiently strong thermal contrast between water temperatures and land temperatures, a land/sea breeze circulation (or conversely, land/lake breeze) will control air motions in the vicinity of the shoreline.

Figure 8 displays the characteristic circulation patterns associated with a lake (or sea) breeze (8a) and a land breeze (8b). This circulation system is not static. As shown in Figure 9, the convergence zone migrates inland as the land surface heats up. The intensity of the sea breeze may increase through midafternoon, but dies out after sunset as the land surface rapidly cools. At night, the land breeze sets up, but is generally less vigorous because thermal contrasts are smaller.



A. Lake Breeze



B. Land Breeze

Figure 8. Characteristics of lake coast air flow.

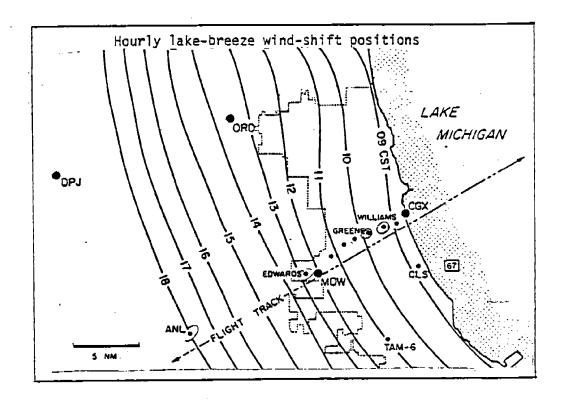


Figure 9. Hourly positions of lake breeze front of August 13, 1967, with the ground track of the NACR Queen air plotted. Hygrothermograph traces at several distances from the shoreline are included. Surface water temperature is 67° F. One full wind barb equals 5 knots. From Lyons and Olsson 1972.

The primary impact of this system is to recompose a coastal monitoring scene into at least two siting domains: one area subject to the land/sea breeze effects, another outside of this influence. The size and extent of the land/sea breeze+affected subarea can be assessed in a number of ways. An obvious factor of contrast is the horizontal distribution of wind directions on appropriate days; however, few areas have sufficiently detailed meteorological networks to define the horizontal extent of the area and the change in size of the affected area with time. A more reasonable approach is to use air temperature and relative humidity patterns to characterize this effect. Figure 9 displays distinctive signatures in hygrothermograph recordings and suggests a method of analysis that may be helpful.

Small Scale Obstacles--

Wind deflection around and over obstacles is a concern in selecting specific sites in an urban area, because the effects occur on the microscale. As shown in Figure 10, air does not simply slip past an isolated structure. There are three distinguishable zones of air around a building:

- Displacement zone--where streamlines are deflected upwind and outward, remaining so for some distance
- 2. Wake zone--where streamlines gradually recover original configuration
- Cavity zone--return flow in the immediate vicinity of the downwind side.

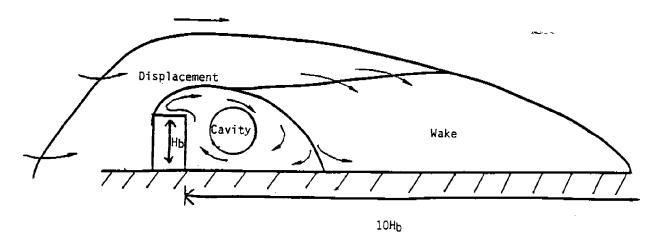


Figure 10. Flow zones around a building

In terms of site selection, this effect is of obvious importance if an intervening obstacle contains a strong enough source to generate a ground-level impact that would be assigned to a source further upstream--particularly if monitoring were to unwittingly take place in the cavity zone. This effect is further complicated when many such obstacles are placed together, as shown in Figure 11.

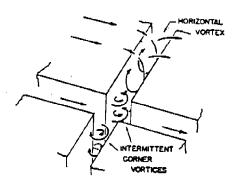


Figure 11. Flow characteristics among multiple buildings.

Urban Effects--

In addition to the effects of individual buildings, a city induces large-scale modifications to the local wind field. These modifications have a bearing on site selection, due to the heat island circulation.

When a heat island circulation exists, there is a convergence zone over the center of the city and a return flow into outlying areas, as illustrated in Figure 12. This circulation pattern is most pronounced at night when differential radiative cooling rates favor higher temperatures in the urban center. The circulation pattern is generally weaker during the day when urban/rural thermal contrasts are not as strong. Table 7 summarizes the general magnitude of key heat island circulation elements.

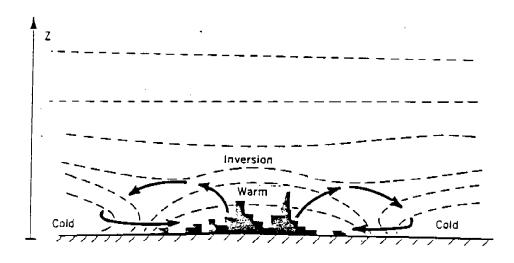


Figure 12. Idealized urban heat island air flow (After Landsberg 1975).

TABLE 7. ESTIMATES OF THE ST. LOUIS, MISSOURI, HEAT ISLAND CIRCULATION

El ement	General magnitude
Urban/rural temperature difference	<u>></u> 2°C
Gradient wind (900 mb)	<u>></u> 5 m/sec
Average surface wind	2 m/sec
Average vertical velocity	0.3 m/sec
Diameter of surface inflow	30 km
Diameter of updraft	7 km
Depth of circulation	1 km

Source: Landsberg.

Under sufficiently strong winds, the heat island circulation is overwhelmed. Oke and Hannel (1970) have developed a simple relationship between the threshold wind speed to prohibit the circulation and relative city size. Oke and Hannel's empirical formulation is as follows:

$$U_{1 im} = 3.4 \text{ LogP-11.6}$$

where P is the population number. Thus, a large urban area whose population is counted in the millions can exhibit a heat island circulation even if regional winds are quite strong. Although this relationship showed a high correlation (94 percent variance explained) for the cities studied, it should not be treated as an absolute measure. Each urban setting will have its own idiosyncracies due to local terrain, presence of water bodies, or other factors.

Climatology

Regional dispersion climatology encompasses those atmospheric parameters of regional scale influence that affect the distribution of ambient concentration. The parameters of primary concern are advection, dispersion, and vertical mixing. With the exception of advection (i.e., surface winds), the instrumentation to acquire direct measures of these parameters are generally not found in most settings. Even when relevant measurements are available, the important fine structure needed to characterize significant air pollution

transport is generally not observed (e.g., Hewson 1976; Holzworth 1974; and McCormick and Holzworth 1976). Nevertheless, it is important to consider what regular data are available to estimate advection, dispersion, and vertical mixing. Additional parameters needed for air quality simulations are also considered.

Advection--

For most monitoring objectives, advection is adequately defined by the near-surface wind (speed and direction) measured at (or adjusted to) a reference height of 10 meters above the ground. Useful observations may consist of short-term averages taken hourly or every 3 hours, as well as true algebraic or vectorial averages over these time intervals. Nearly continuous recordings are sometimes available.

Directional air flow is an intuitively appealing siting tool. One of the most useful summary depictions is the wind use that expresses advection in terms of relative frequency of occurrence by direction, usually with a breakdown of wind speed by classes within each directional interval—By convention, a wind direction denotes the sector from which wind is blowing. Wind roses may be compared on an 8-point basis, a 16-point basis, or a 36-point basis.

The most common summary wind roses are compared for annual, seasonal, or monthly distributions (see Figure 13). Under some circumstances, wind roses are devised to study winds under critical conditions. For example, STAR¹ summaries offer a joint frequency distribution of winds and atmospheric stability. These are available from the National Climatic Center and may be compared for various time periods. Additional categories of wind roses include winds under important pollutant index levels, distribution of persistent 24-hour winds, and distributions within key parts of the day (i.e., morning versus afternoon).

Dispersion--

Dispersion is the summary effect of atmospheric turbulence in actively diluting source material. Direct measurements of the three-dimensional wind fluctuations that manifest turbulence are rarely made. Instead, various methods of characterizing turbulence based on theoretical and empirical relationships are employed. The most common system is based upon associations among wind speed, solar insolation, and cloud cover, as shown in Table 8. Many operational models accept this type of data directly, and manual techniques have evolved to treat these as well (see Turner 1970).

¹ STability ARray, a broad-based algorithm for determining stability in the lower atmosphere using estimates based on winds and cloudiness. See Doty, Wallace, and Holzworth 1976.

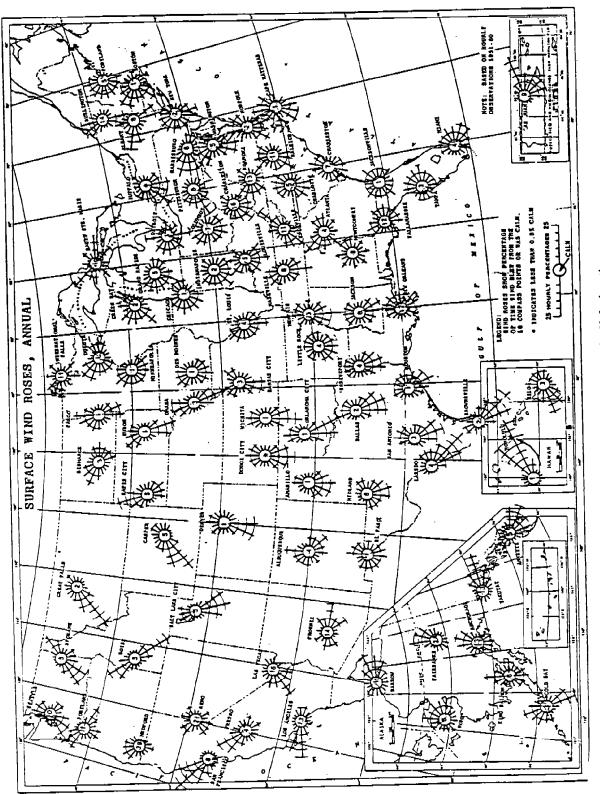


Figure 13. Annual wind roses for U.S. locations.

TABLE 8. DISPERSION CLASSIFICATIONS (PASQUILL 1961)

•				Night		
Surface wind speed at 10 m	<u>. </u>	Insolation	· •	Thinly overcast		
(m sec-1)	Strong	Moderate	S1 ight	or <u>></u> 4/8 low cloud	<3/8 cloud	
2	A	A-B	В	-	 – –	
2-3	A-B	В	С	E	F	
3-5	В	B-C	С	D	E	
5-6	С	C-D	D	D	D	
>6	C .	C	D	· D	D	

Mixing Height--

Mixing height defines the vertical extent of mixing. Ground-based and low-level inversions are the principal limiting factors. Mixing height is determined from a thermodynamic analysis of vertical temperature soundings. These soundings are routinely performed at 0000 GMT and 1200 GMT each day at a number of stations. Contact National Climactic Center (see Appendix A) for a list. Additionally, climatological summaries are also available (see Holzworth 1972).

Other Parameters--

Additional parameters that may be useful are listed below. Routine data sources are summarized in Appendix B.

- Solar radiation--for estimates of formation rates of secondary aerosols
- Visibility--as a proxy for regional scale impacts
- Precipitation--to relate to scavenging processes
- Air temperature--to be applied to plume rise estimates, or as a fine adjustment to residential space heating demand as a proxy for some combustion sources.

TAXONOMY OF REPRESENTATIVE SITES

By classifying monitoring objectives and monitoring sites, it is possible to categorize all monitoring requirements into discrete groupings. Siting methods that are appropriate to each group or to several groups can be more easily identified. Furthermore, some groupings may be of little interest and need not receive further attention.

In the preceding section, spatial scales of areas were defined within which air quality levels are reasonably homogeneous for typical organizations of human structures and activities that characterize each scale. These definitions were very general. The physical characteristics that primarily contribute to variations in air quality include sources of emissions, types of terrain, and types of meteorological influences. Each of these characteristics and the nature of the variations that affect air quality levels have been previously discussed.

For the purpose of classifying representative siting situations with respect to PM_{10} , the following three categories of sources of emissions are of interest:

- Background or general region
- General urban or industrial area
 - Homogeneous
 - Complex
- Major source within an urban area
- Isolated source.

With respect to terrain influences the following categories of topographical features are of interest:

- Plains
- Coast
- Ridge and valley
- Irregular terrain
 - Extremely rough
 - Moderately rough
- Urban.

Although mixtures of the above terrain influences are possible, it is unrealistic to attempt to characterize such complex influences within the scope of present modeling and analysis methods. For monitoring planning purposes, it may be best to incorporate the single most important influence into the analysis.

With respect to meteorological influences on air quality levels, there are two important categories of features that have been frequently cited as being important in creating poor air quality levels. These categories are (1) stagnation situations with limited vertical mixing and little advection for prolonged periods and (2) persistent winds in which pollution from a source is consistently transported to the same location for a prolonged period. The following categories of meteorological influences are of interest:

- Frequent air stagnation conditions
- Frequent persistent winds
- Normally variable meteorological conditions.

For PM_{10} air quality levels, there are two averaging times of interest: 24-hour and 1-year. The pattern of effects associated with these two averaging periods may differ, in that shorter term effects usually occur closer to the source than do longer term effects.

Based on the above factors, there are 120 possible representative siting situations consisting of all the following combinations:

4 classes of sources 5 classes of terrain 3 classes of meteorology 2 classes of averaging times.

However, for the purpose of identifying methodologies to use in determining siting needs, the same approach is applicable to many of the combinations. One need not use different approaches to treat different averaging times. Also, the meteorological influences are associated with the influences due to terrain and need not be treated as independent factors. Eliminating time and meteorology reduces the number of combinations to 20. With regard to air quality levels associated with background or distance sources that affect a general region as a whole, variations in terrain are not important. The concentrations of PM₁₀ will be homogeneous over large areas and not affected by terrain variations. Siting methodologies are limited to simple situations in which a single dominant terrain is identified. At the present time, oratical methodologies have not been developed for treating multiple sources in other than simple terrain situations. Practical models for treating coastal, ridge/valley, and irregular terrain for general urban sources or a major source in conjunction with general urban sources are not presented here. These two source categories are not applicable to the terrain type, leaving only the urban terrain situation. This leaves the terrain variation being treated only with respect to isolated sources.

There are only two terrain situations applicable to isolated sources since the isolated source with urban terrain is the same case as a major source within an urban area. This results in four categories of sites. Because of the range of alternative configurations of sources in urban areas, two categories are included, which may be designated complex and uniform.

As a result of these considerations, we have defined the following six representative siting situations for which specific guidelines are presented in the next section:

- Regional scale (1)
- General urban area
 - Complex (2)
 - Uniform (3)
- Major source within urban area (4)
- o Isolated source
 - Plains (5)
 - Irregular terrain (6)

SECTION 5

SITE SELECTION METHODOLOGY

The general procedure recommended for selecting sites for monitoring PM_{10} is similar to that followed for monitoring any pollutant. Variations are recommended primarily with regard to specific methodologies or data that are needed for different topographical situations or different configurations of emissions. Procedures are discussed and recommendations are given for treating the six representative siting situations identified for PM_{10} in Section 4.

OVERVIEW OF METHODOLOGY

The siting of monitors is part of a continuing planning cycle for monitoring, which goes on in all air pollution control agencies and operating facilities. The three basic elements of the cycle, as shown in Figure 14, include defining the objective of monitoring, collecting monitoring data, and making judgments about air quality levels. The methodology for selecting monitoring sites is designed with the idea that this is part of an iterative process that has been performed before and will be repeated again in the future. The need for flexibility in the use of monitoring resources was clearly recognized by the Standing Air Monitoring Working Group (EPA 1977). This need has resulted in the development of three types of monitoring activities by state and local agencies, including National Air Monitoring Stations (NAMS), State and Local Air Monitoring Stations (SLAMS), and Special Purpose Monitoring (SPM). The locations of NAMS and SLAMS must be coordinated with EPA regional offices because these must be designed to meet EPA needs in addition to state and local needs. The siting methodology is applicable to all three types of monitoring stations and will be useful to industrial operating facilities as well as air pollution control agencies.

The general site selection process is illustrated in Figure 15. The procedure is applicable to all PM₁₀ siting requirements, although the indicated steps may be considerably simpler for some types of monitoring requirements than for others. Each box shown in the diagram defines a data review and analysis step. The diamonds define decisions, and the rounded boxes define data needs. The process is divided into the following six steps, which are performed in sequence:

- 1. Analyze existing PM monitoring data
- 2. Review local situation to determine adequacy of mapping analysis and/or to select a modeling procedure
- Model air quality scene (if necessary)
- 4. Determine network requirements

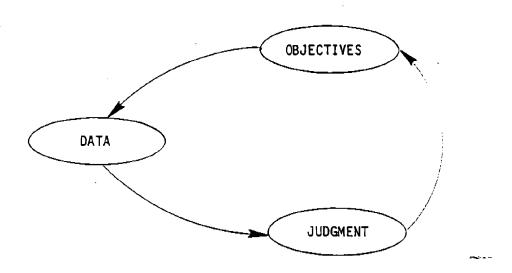


Figure 14. Planning cycle for monitoring.

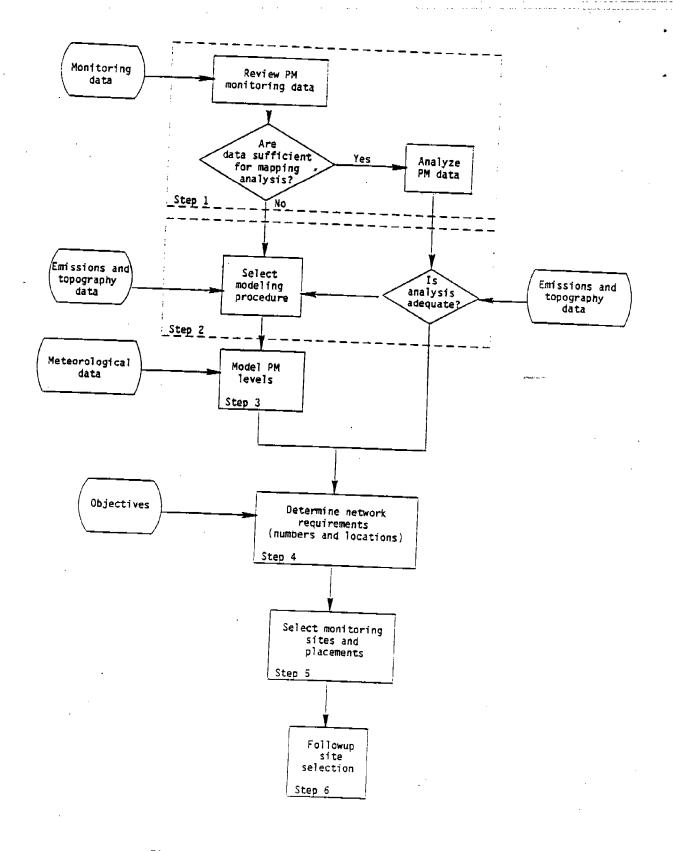


Figure 15. Procedure for selecting PM_{10} monitoring sites.

- 5. Determine monitoring sites and placement
- 6. Document and update site exposure experience.

Site planning may vary in scope of responsibility and may include any of the following:

- Design multipurpose network
- Supplement existing network for specific purpose
- Design single-source impact or compliance monitoring network
- Monitor a designated area or location.

Guidelines for performing each step in the site selection process and variations that deal specifically with each of the six types of siting situations are described in the subsequent subsections.

ANALYZE EXISTING AMBIENT PM MONITORING DATA

In order to devise a monitoring strategy and select monitoring sites, the monitoring planner must hypothesize the historical spatial distribution of PM10 concentrations over the area of concern. An adequate data base of related measurements, such as for TSP matter, may be available to meet this need. If not, the distribution must be estimated by mathematical simulation modeling or by a reasonable, physically based qualitative analysis. The best method of estimating the distribution of air quality levels will depend on the amount, type, and quality of available information. The information of interest includes the following categories:

- Suspended particulate matter measurements
- Locations and amounts of particulate emissions
- Air pollution climatology and meteorology data
- Maps of topographical features.

As a general rule, the amount of monitoring data available to help design a monitoring network or site new monitors is either nonexistent or very incomplete. However, with regard to siting new PM10 monitors, there is likely to be a wealth of hi-vol monitoring data for TSP concentrations that can be very helpful. Other relevant ambient PM measurements include IP measurements, tape sampler measurements, and various types of direct and

indirect PM measurements. The EPA SAROAD data base, available from EPA regional offices, is a convenient source of much of the available data. State and local air pollution control offices are also important sources of additional data and information about other data that may have been collected by nongovernment parties or in special studies.

After assembly of all available data and elimination of data that are suspect because of poor quality control, a decision is made as to whether the available data is sufficiently dense to justify mapping analysis, or whether single-station analysis is more valuable. Generally, unless measurements are available from at least six sites concurrently, mapping analysis is not practical.

Mapping Analysis

When performing mapping analyses, different types of measurement data should not be mixed on the same map unless an adequate calibration correction is made for different types of data. If corrections are to be made; it would be convenient if the different types of measurements were corrected to estimates of PM_{10} concentrations. As a minimum, two types of maps should be constructed, including one for annual means and one for peak 24-hour concentrations (not concurrent) for each year of data, particularly the most recent years. In addition, it will be useful to plot concurrent 24-hour data for a few days that are distinguished by having one or more high values. The maps may be constructed by locating the observing sites on a convenient mapping display. The appropriate values may be entered at each site to provide a quide for drawing a set of representative contours of concentrations. The number and value of contours to be drawn will depend on the range of values observed and the nature of their spatial distribution. Computer graphics packages are available to perform the contouring analysis if manual analysis is not practical. Generally, about six contours will provide a useful display. However, as few as one or as many as 10 may be appropriate, depending on the magnitude of the range relative to the mean of the values observed. The maps will be used to identify representative spatial scales and preliminary siting selections.

While the mapping and station analysis data may be helpful in identifying the spatial distribution of PM_{10} , they may be inadequate. Having analyzed the available data, the monitoring planner must consider whether modeling is needed to supplement the available monitoring data. Consideration should be given to gradients evident in the observations, locations of major sources, terrain, and meteorology. In most cases the available PM observations will not be adequate for planning a new monitoring network.

Single-Station Analysis

When single-station analyses are performed, it is desirable to identify the significant influencing factors that affect the PM10 air quality levels observed. This identification process will help determine how wide an area

the station represents. Conclusions drawn from one station should be compared with results from other stations in the area of interest. Trends and frequency distributions help in analyzing single-station data. Case study analyses of peak values will also be helpful. Figure 16 shows an example of 12-month running means for three sites in Youngstown, Ohio. When significant trends exist, they may indicate the influence of a nearby source. This would be especially true if trends at one site are more pronounced than at other sites. The down trends at the three Youngstown stations might be attributed to decreasing steel production in the local area. The differences among the stations might be attributed to the locations of sites relative to steel production areas and the prevailing wind directions. Shorter averaging periods, such as 3-month averages, would be helpful in identifying seasonal variations that might be associated with specific sources or meteorological conditions.

An example of statistical analysis of single-station data is presented in Table 9. Locations that have similar frequency distributions, particularly over a period of several years, can be considered to be in homogeneous areas. To further support the identification of homogeneous areas, it is useful to review meteorological conditions associated with a selected range of high values. Because TSP measurements represent 24-hour values, a good deal of care is required in selecting meaningful meteorological values. The prevailing (most frequent) and the range of wind directions corresponding to the measurement period are useful. Wind persistence (ratio of vector mean to scalar mean wind speed), height and magnitude of nocturnal temperature inversion, scalar average wind speed, and range of Pasquill stability categories (see definition in Turner 1970) are other meteorological parameters that may show consistent values with the high TSP measurements. If the meteorological conditions associated with high measurements differ significantly between monitoring sites, this result indicates that the sites represent different zones of air quality and has an important bearing in planning a monitoring network.

Another useful single-station analysis is the pollution rose. Figure 17 shows pollution roses constructed for four sites near a coking plant. The pollution rose is constructed by computing the average measured concentration for all values when the prevailing wind was in a given direction. The values may be limited to days when the wind persistence index (ratios of vector to scalar wind speed) exceeds a certain value. In Figure 17, the data include only days with a wind persistence index equal to or greater than 0.85.

REVIEW OF LOCAL SITUATION

An important step in the process of selecting monitoring sites is to identify the unique local influences that are affecting air quality. The types of topographical features, the magnitudes of PM emissions, and the locations of both with respect to one another have a major impact on where the worst air quality levels will occur. In assessing the value of available monitoring data and in selecting an air quality simulation model, it is necessary to take these local influences into account. After a brief

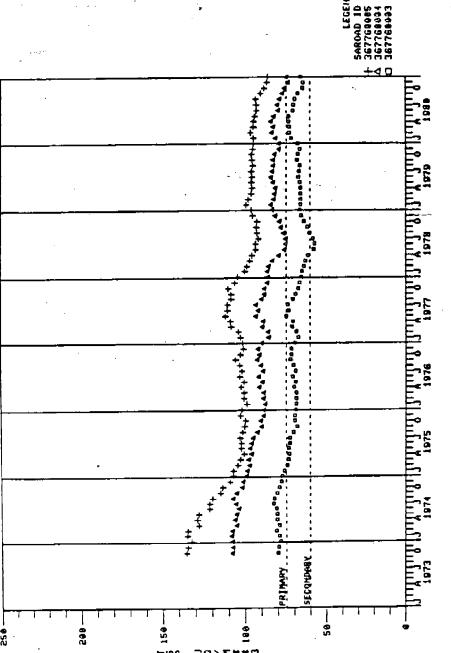


Figure 16. Twelve-month running geometric means (Pickering, Vilardo, and Rector 1981).

TABLE 9. TSP DATA SUMMARY FOR SAROAD STATION #391720001 (Units in micrograms/ m^3) (Pickering, Vilardo, and Rector 1981)

FABY	1973	1974	1975	1975	1977	1978	1979	1980
# OF READINGS :	59	٤١	95	109	113	110	113	7 9
GEOMETRIC MEAN:	122.5	114.9	139.2	₹0.2	99.2	95.9	35.0	93.1
GEOMETRIC S.D.:	1.8	1.6	1.6	1.5	1.7	1 -7	1.5	1.5
HIGHEST BY LARSEN EXTRP:	635.4	460-4	406.4	326.1	440.3	431.4	233.5	319.5
1ST HIGHEST: DATE :	485+0 730415	295.0 740117	314-0 750418	259.0 760915	275.0 770310	365.0 78942 <u>6</u>	273 - 0 27322	355.0 900531
2ND HIGHEST: DATE :	339.0 730425	281.0 740905	277.0 750924	204.0 750924	1231.0 771105	237.0 781122	225.0 791123	194.0 500507
# OF READINGS EXCEEDING 250:	4	4	3	0	1	1	1	1
# OF READINGS EXCEEDING 150 :	2 4	20	22	17	27	19	3	10
RANGE								
0- 65:	. 9	11	15	29	2.5	27	36	15
66-130:	20	. 37	4.8	54	49	48	52	45
131+195:	20	22	20	23	32	27	11	15
196-250:	. 5	7	9	3	5	7	3	 1
261-325:	2	4	3	ŋ	1	ŋ	1	0
326-390:	1	٥	o	О	ŋ	1	0	1
571 - 4 55:	э	n	0	.0	C	0	, 0	0
>435:	1	3	õ	ŋ	σ	٥	0	9

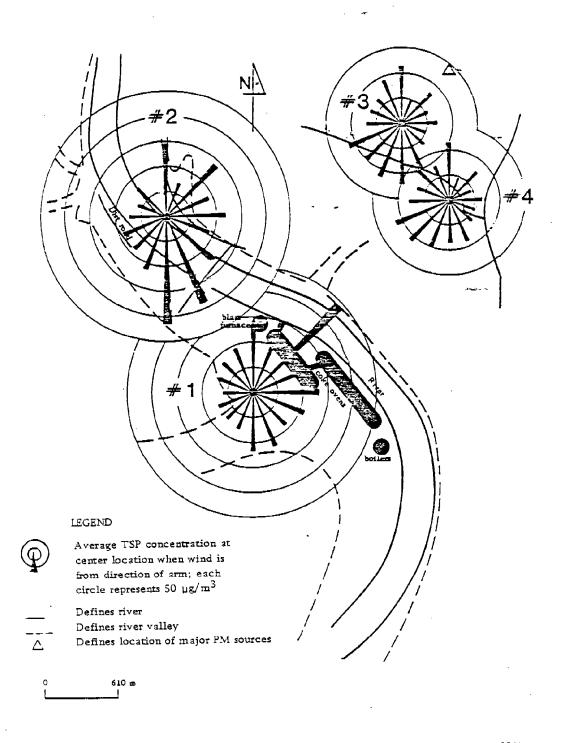


Figure 17. TSP roses for four sites near a coking plant (Pickering, Vilardo, and Rector 1981).

description of the information needed, suggestions are given for steps to take in evaluating available air quality and for estimating PM_{10} air quality levels by the use of mathematical models.

Emission Data

Information on the locations and magnitudes of sources of particulate matter emissions is needed. The influence of PM_{10} sources can be determined by the use of air quality dispersion models and graphical aides that treat the contributions of sources to receptor locations, and by qualitative interpretation of the model results in the light of known topographic influences and monitoring data. Available sources of data and how they may be used in monitor siting analysis is provided here.

Two useful items of information are a detailed and accurate land use map and an accurate point source emission inventory. Large-area, statewide, or multistate maps are needed to show the locations of major population and industrial areas. Smaller area maps that show the size and location of different types of urban development within a single city are also needed for most monitoring objectives. There are many sources for the large-area maps. City-size land use maps are usually available from city and county planning offices. U.S. Geological Survey maps or Sanborn maps may be useful if other sources of land use maps are not available. Another very useful source of data on land use is the U.S. Geological Survey's records of aerial photographic coverage and space imagery. Reference files of data available on microfilm are maintained at the EROS Data Center of the U.S. Geological Survey in Sioux Falls, South Dakota. (See Appendix B for recommended contacts.)

Detailed information on specific sources of particulate emissions is available in state and local emission inventories. Both area and point source emission data are needed. Area source emissions are typically estimated on a countywide basis. However, estimates are frequently allocated to a fine grid in order to provide inputs to dispersion models or for other purposes. Gridded area source data that include location, emission rate, and stack parameters (e.g., temperature and volume flow rate) are needed. When accurate and complete, the NEDS data available from EPA include peak and average emission rates and seasonal variations in addition to the minimum information on location and emissions.

In addition to the emission inventory, census data and traffic data may be used to help define the spatial distribution of particulate emissions, particularly emissions associated with fuel combustion for space heating and emissions from vehicle kickup and tailpipe exhaust. If seasonal variations of emissions due to space heating are not available, they can be estimated on a seasonal or daily basis by use of degree days. 1

A degree day is the amount that the average of the daily maximum and minimum temperatures is less than 65° F. Days on which the average is 65° F or greater are not counted.

Emission data for particulate matter are most complete and most accurate for stack emissions from large point sources. However, the principal sources of PM10 concentrations are fugitive emissions, secondary particles, and emissions from automobile exhaust (Watson, Chow, and Shah 1981). Special attention is needed to ensure that the emission inventory is reasonably accurate with respect to industrial material handling operations, fumes from uncontained processes, mechanically reentrained road dust (both paved and unpaved roads), and windblown dust from disturbed soil, or a variety of industrial sources (Pace 1980).

Topography

The topography of an area will affect the transport and dispersion of pollutants released to the atmosphere. It is important to take note of topographical features in evaluating how adequately monitoring data represent the expected air quality levels and in selecting a modeling approach for simulating air quality levels. The following topographical features are of interest:

- Shorelines of major bodies of water
- Boundaries of significant urban areas (primarily covered by buildings and pavement)
- Significant terrain elevation features, including ridges, valleys, and areas of complex terrain.

The influence of topography on atmospheric transport is discussed in Section 4. The location of air monitoring sites in relation to sources of PM emissions must be reviewed in the light of these influences. An air pollution meteorologist may be consulted regarding the significance of topographical effects, if there is a doubt about the effect.

The locations of these features are easily identified on topographical maps available from the U.S. Geological Survey.

Reviewing Local Effects

Having assembled data that describe the local situation with regard to measurements of air quality, sources of emissions, meteorology, and terrain, the monitoring site planner is ready to assess the nature of these influences and determine whether to use modeling or qualitative analysis for assistance in selecting monitoring sites.

With regard to sources of particulate emissions, it is necessary to identify the locations of major sources and the quantity of emissions emanating both from stacks and as fugitive dust. Smaller sources of particulate emissions may be represented as area sources, e.g., as emission densities over 1 km squares. The area source emission densities should include particulate emissions from fuel combustion by smaller commercial and industrial sources, by residences, and by all types of mobile sources; also, process and fugitive dust emissions from industrial, waste disposal, and construction operations should be included. Guidelines on how to conduct an emission inventory and to allocate emission data to a gridwork are available from EPA (1973) and are not documented here. Both annual mean and seasonal, monthly, or daily maximum (if they are significantly different from the annual) emission rates should be determined. When plotted on maps, the area emission densities (both mean and maximum) will indicate areas of relative maximum and minimum emission levels and the degree of homogeneity in the area source emissions over the monitoring area of interest.

The nature of major topographical features and their locations relative to the sources of particulate emissions need to be identified. Major topographical features include coastlines, ridge lines, valley walls, and hilltops. In addition to specific topographical features, the area may be generally characterized by its roughness, e.g., built-up urban area, moderately rough rolling hills or river valley, or extremely rough valleys and ridges of a mountainous area. The treatment of terrain roughness is further complicated by the need to deal with terrain transitions. Cities and other areas of interest are frequently located near the base of a mountainous area or on a coastline where major terrain transitions exist.

While the location and nature of terrain features help to identify their influence, meteorological data are the demonstrated evidence of the effect. All of the air quality models recommended in the EPA <u>Guideline on Air Quality Models (Revised) (1986)</u> assume that meteorological conditions are homogeneous between all combinations of sources and receptors. Therefore, the available meteorological data should be reviewed to delineate areas and time for which the homogeneity assumption and the recommended models are applicable.

The single most significant meteorological parameter that must be homogeneous is wind direction. Since wind direction at a single site is generally accurate within 10° azimuth, 2 the variance in wind direction differences between sites should not exceed the sum of that variance due to measurement errors at the two sites. A useful rule of thumb is that the standard deviation of the differences in wind direction at two sites should not exceed $\sqrt{2}$ times 10° , or be less 15° , if the two sites are assumed to be measuring the same wind direction.

²This is related to the spatial representativeness of the observations and not the accuracy of the wind vane.

If meteorological data are not available to demonstrate the homogeneity of meteorological conditions, one can require that there be no major topographical features between sources of pollution and potential receptor monitoring sites in areas selected for modeling analysis. While this may be helpful in the immediate area, it does not treat indirect effects in nearby areas due to wind flow away from major topographical features. Lake breeze fronts and valley drainage flow fronts are examples of air boundaries that lie away from the topographical features that generate them. Winds on opposite sides of these air boundaries may differ by 90° or more, and the boundary may lie several miles away from the terrain feature. Air quality models that treat the effects of these terrain-generated air boundaries are under development and evaluation. One important effect of these boundaries, namely limited vertical mixing, can be treated by the available models.

Is the Analysis of Monitoring Data Sufficient?

The patterns and directions of maximum levels may differ for long- and short-term PM_{10} concentrations. Both types of patterns should be reviewed separately. The important judgment to be made is whether the effects shown by the monitoring data are reasonable in the light of other available information, or whether modeling is needed to better define the spatial pattern of PM_{10} concentrations.

In order to be useful for siting purposes, the monitoring data should define the shape and magnitude of the air quality pattern. Based on the distribution of sources, topography, and meteorology, the pattern should reflect these influences or at least not be inconsistent with respect to them. If these expectations are met, one may accept the pattern shown by the monitoring data as adequate. If the expectations are not met, a more detailed analysis based on results from air quality simulation models or from supplementary mobile monitoring may be required. There are two types of comparisons that can be made to help judge whether the air quality patterns are acceptable. One comparison examines the time history of the pattern. The other comparison examines the shape of the air quality pattern with respect to the shape of the pattern of emission densities and topographical features.

If the patterns of annual means or maximum 24-hour concentrations for several years show the same shape and same locations of peaks when superimposed on each other, the pattern is consistent with time. This consistency is evidence of a stable pattern, which is a reasonable guide for planning monitoring sites. If the pattern is changing with time, the analysis may be adequate, but the reasons for the changing pattern should make sense in terms of changes in sources or in meteorological conditions. If there are no apparent reasons for the changes, modeling results should be obtained and reviewed.

Emission densities that are chronologically consistent with the air quality data should be plotted and used to generate contour patterns. Topographical features may also be located on these patterns. When the emission density contours are superimposed on the air quality patterns, there

should be a reasonable relationship. One possible cause of deviations might be due to significant amounts of emissions from stacks. The heights of the stacks should be noted as an aid in identifying this influence. As a general rule, most IP and TSP emissions are from ground-level sources; however, uncontrolled or undercontrolled emissions from stacks can be major sources of pollution, which significantly alters the pattern of air quality from what would be observed from ground-level sources. A reasonably consistent pattern would be one in which the air quality pattern is offset from the emission pattern in the direction of prevailing wind flow. If the influence of major peaks in emission density are not evident in the air quality pattern, a modeling analysis may be helpful in identifying the magnitude of the pattern deformation that can be expected.

Selecting a Model

Major unsolved problems are associated with modeling PM concentrations. When using the results of model simulations to select monitoring sites, one should keep the following uncertainties in mind:

- Most of the IP matter that makes up the concentrations occurring in urban locations may not originate from local sources.
- Air quality simulation models recommended in the Guideline (EPA 1986) do not treat the physical and chemical processes that alter the size of airborne particles and may not adequately treat their removal by wet and/or dry deposition.
- Emission factors and emission data that are available to estimate emissions of particulate matter do not identify IP emissions as a portion of total PM emissions.
- Most IP emissions originate from fugitive sources rather than stacks. The uncertainly associated with available fugitive emission estimates is very high.
- Air quality simulation models recommended in the Guideline (EPA 1986) very simplistically treat the topographical influences on atmospheric transport and dispersion of pollutants.

In spite of these uncertainties it is still useful to use modeling to identify areas of relatively good and poor air quality and to select sites for a monitoring network. Models that may be useful in each of the six monitoring situations described at the end of Section 4 are listed in Table 10. No modeling results are needed to site a regional scale monitoring station, because this type of site is representative of a large, relatively nomogeneous area of air quality in which influences from nearby sources are

TABLE 10. AVAILABLE EPA MODELS FOR SIX MONITORING SITUATIONS*

·	Recommended model			
Monitoring Situation	Annual Mean	Maximum 24-hour		
Regional scale	None**	None**		
General urban area unitorm for complex sources in urban areas	CDM-2.0	RAM ISC		
Urban area with single or multiple major IP source(s)	CDM-2.0	RAM		
Single source with terrain height below stack top# (complex source)	CRSTER	CRSTER (ISC		
Single source near terrain above stack top§	COMPLEX I*	** VALLEY or COMPLEX I***		

^{*} Available on EPA's UNAMAP Version 6.

[#] For multiple sources where it is not appropriate to consider the emissions as located at a single point, the MPTER model is appropriate.

[§] COMPLEX I and VALLEY are considered screening techniques. For regulatory purposes, COMPLEX I should be used only with onsite meteorological data as input.

^{**} Selection of model is a case-by-case decision.

^{***} The SHORTZ model is an appropriate screening technique for use in urbanized valleys with onsite meteorological data as input.

negligible. With regard to selecting a model, a distinction is made betwen monitoring situations with a single source in a rural setting and monitoring situations with multiple sources in an urban setting. A distinction is also made between rural monitoring situations with and without complex terrain. For modeling purposes, complex terrain is usually defined as terrain that exceeds the stack top of the source.

For estimating annual means, the CDM model is appropriate for multiple source urban situations, and the CRSTER model is recommended for single-source rural situations in the absence of complex terrain. In the presence of complex terrain, the COMPLEX I screening model for rural areas and the SHORTZ screening model for urban areas (available in the EPA UNAMAP Program System, Version 6) are more appropriate than VALLEY, if at least 1 year of onsite meteorological data are available. These models are relatively easy and inexpensive to use. For estimating maximum 24-hour concentrations, the RAM model is recommended for urban situations and CRSTER for single-source, rural situations. When the single source or multiple major IP sources are complex (as is frequently the case when treating fugitive emissions from large industrial sources), the ISC model is recommended in place of RAM or CRSTER.

Procedures for using these models and for compiling data for them are discussed in detail in the <u>Guideline on Air Quality Models (Revised)</u> (EPA 1986), and the PM $_{10}$ SIP Guideline. In addition, Appendix A contains a list of cities for which STAR data have been compiled. These data should be helpful to modelers who wish to execute CDM or ISCLT. Appendix B contains a list of information sources that should also prove helpful.

Selecting Representative Sites Without Monitoring or Modeling Data

There may be situations in which it is not possible to use monitoring data or the results of a modeling analysis to define the pattern of air quality levels in an area that is to be monitored. In this case, the monitoring network can be planned by identifying representative sites on the basis of available information on sources of emissions, climatological data, and topographical considerations. Section 4 presents a discussion of how these physical characteristics of the area to be monitored influence the air quality with respect to PM_{10} . On the basis of these considerations, six representative monitoring situations were identified. Observations from other locations and previous modeling analyses of general classes of source influences may be used to select PM_{10} monitoring sites for these situations.

Figures 18 through 21 summarize the steps that need to be followed in selecting sites for the six types of representative monitoring situations. Figure 18 treats regional scale siting. Figure 19 treats siting neighborhood-scale sites in urban areas, and Figure 20 treats siting middle scale sites with and without the presence of major point sources. These two figures cover the three urban representative siting situations identified in Section 4. Figure 21 treats siting around an isolated major point source in flat or

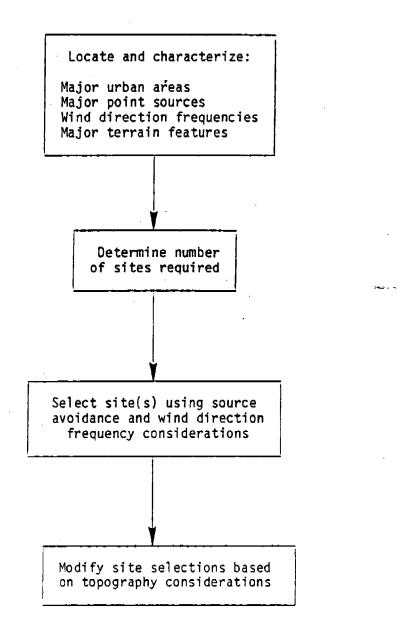


Figure 18. Steps for locating regional scale monitoring site.

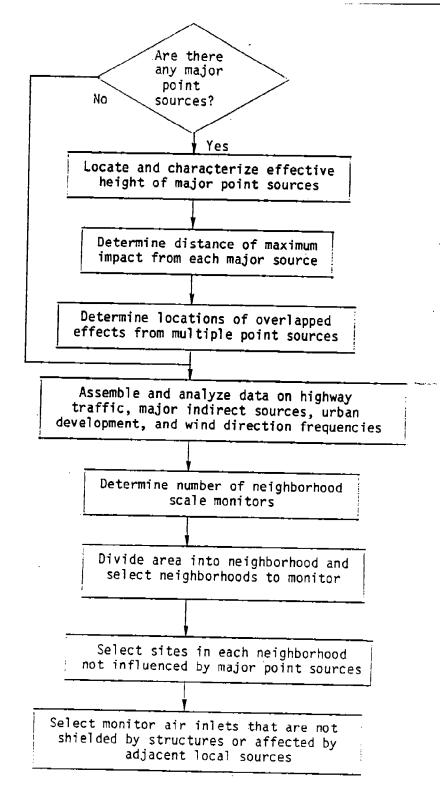


Figure 19. Steps for locating a neighborhood scale monitoring site in an urban area.

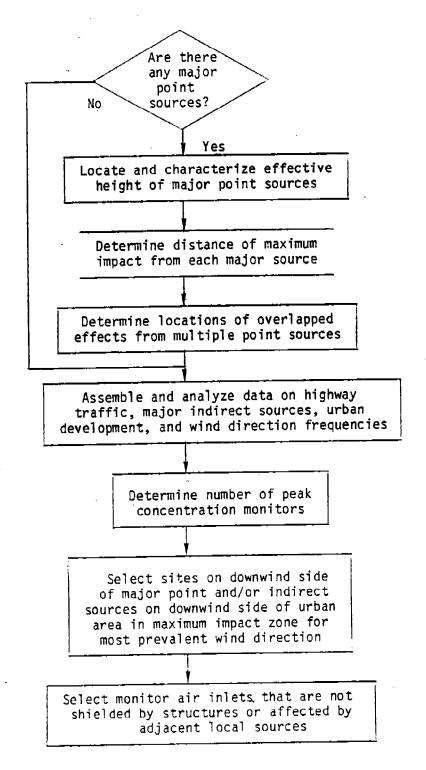


Figure 20. Steps for locating micro-/middle scale monitoring sites in urban areas.

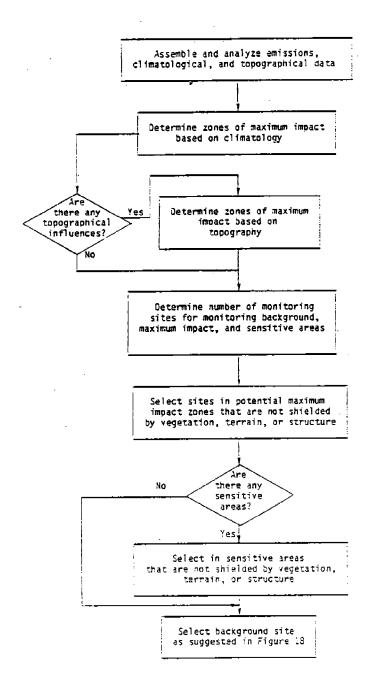


Figure 21. Steps for locating monitoring sites near isolated major sources.

complex terrain. This includes two of the representative siting situations. These three figures deal with all six representative siting situations. Specific guidelines that may be used in performing these steps are discussed below.

Regional Scale Monitoring Sites

Regional scale monitoring sites are needed to measure background levels of PM10 that are transported into the area being monitored. It is important that regional scale monitoring sites not be affected by nearby sources, which would significantly alter their scales of representativeness, for large periods of time. It may be necessary to use two or more sites to measure background concentrations when a single site cannot be found that is never influenced by nearby sources. Figure 18 suggests four steps to follow in selecting the site(s).

The first step is to identify all major urban areas and all major operating facilities that may have an effect on PM_{10} air quality levels in the area of concern. Locations and populations of nearby urban areas are readily determined from maps and standard library references. Large cities as far away as 100 km are of concern. This is based on the use of models to estimate the distance to which emissions of 1.0 µg/m²/sec from a metropolitan area 40 km in diameter will extend before the peak concentration is less than 20 $\mu g/m^3$ under neutral atmospheric stability conditions and a light wind speed of 2 m/sec. Distances from smaller cities are less critical; e.g., a concentration of 20 $\mu g/m^3$ will extend 60 km downwind of a city that is 20 km in diameter and 15 km downwind of a city that is 10 km in diameter. These estimates were derived using the methodology for Estimation of Concentrations from Area Sources proposed by D.B. Turner (1974). A concentration of 20 $\mu g/m^3$ is significant because this is the 1-hour concentration that is likely to be associated with an observed 24-hour concentration of 5 $\mu g/m^3$, and because 24-hour concentrations as low as 5 $\mu g/m^3$ are small in comparison to observed variations in regional scale IP concentrations. Annual mean concentrations of IP at 17 monitoring sites in nonurban areas (Watson, Chow, and Shah 1981) showed a mean of $30 \, \mu g/m^3$ and a standard deviation of 9 $\mu g/m^3$. A concentration of 5 $\mu g/m^3$ is about half of the standard deviation of regional scale or background level concentrations of IP.

Major operating facilities can be identified from state emission inventories that are available from state and Federal offices listed in Appendix B. Estimates of significant impact distances are listed in Table 11 for various emission rates and effective source heights. Effective source height refers to the height above the ground at which the center of the plume of emissions from a plant is transported. This includes the height of release from a stack or vent plus the rise that may occur due to momentum and/or heat in the exhaust stream. For fugitive emissions blown from the ground or vented from open windows and doors, the effective height may be essentially zero or ground level. All areas affected by major sources can be circled on

a map by a radius scaled to the significant impact distance. The circles should include the urban area and major sources in the area being monitored as well as nearby sources outside of the area. Any areas not covered by circles are suitable for regional-scale monitoring sites. Sites within 40 m of major highways (see Figure 22) or unpaved roads are also not suitable. This is because emissions from motor vehicles in heavy traffic and the reentrainment of dust from unpaved roads are also significant sources of particulate matter. If there are no uncovered areas or if the uncovered areas are unsuitable because of accessibility or other considerations, it is necessary to use more than one site to monitor the regional scale. Operations from different sites would be applicable to background levels on different days.

TABLE 11. DISTANCES FROM MAJOR POINT THAT AFFECT REGIONAL SCALE MONITORS

Emissions rate (g/sec)	Effective source height (m)	concent	trations and w	ind speed doe	the product of s not exceed ability classes E
400	all	14	30	>100	>100
100	300 <150	7 7	14 14	33 50	* >100
40	300 100 <70	4.5 4.5 4.5	7 8 8	25 27	50 57
10	≥300 100 <u><</u> 30	 2.1 2.1	 4 4	 8 10	 11 19
4	100 <30	1.2 1.4	2.0 2.4	5	- - 9

Dashes indicate values as high as 40 μg/m²/sec do not occur.

NOTE: 40 $\mu g/m^2/sec$ represents the lowest value that is expected to produce a 24-hour concentration contribution of at least 5 $\mu g/m^3$. This is based on the assumptions that a 24-hour value will be about 25 percent of the 1-hour peak concentration and that wind speed will be 2 m/sec. A concentration contribution of 5 $\mu g/m^3$ is small in comparison to variations in regional scale IP concentrations (see text). Tabulated values are based on curves from the EPA Workbook of Atmospheric Dispersion Estimates (Turner 1970).

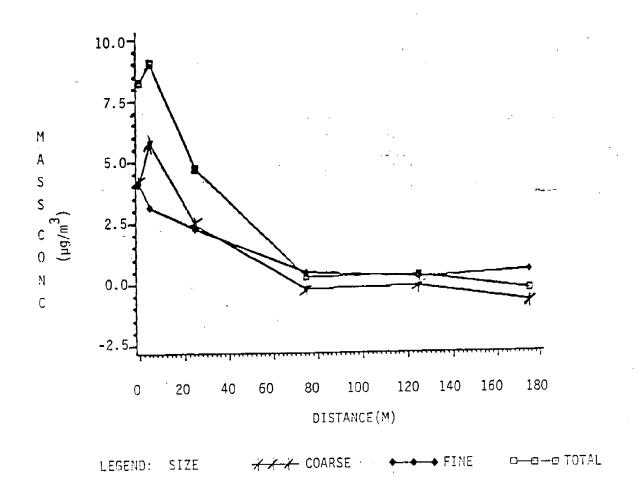


Figure 22. Average measured PM concentrations (downwind less upwind) from a major Philadelphia highway (Burton and Suggs 1982).

When two sites are needed to monitor background concentrations, one station should be selected that is upwind of the area of concern most frequently or downwind least frequently. If this site cannot be clear of contributions from nearby sources for all wind directions, a second site is required. This site should be selected to supplement information obtained from the first site to the maximum extent possible, so that one site or the other is measuring the background level at all times. One strategy is to place the second site in the direction that is upwind of the area of concern second most frequently. If the first and second most frequent wind directions are more than 120° apart, this may be a good plan. If they are less than 90° apart, both sites may be downwind of the primary area of concern or of the same large source on the same day. This risk can be minimized by selecting a second site that has bearing from the primary area of concern that is 180° from the bearing to the first site. A climatological wind rose showing the frequency with which the wind blows in each direction is useful for selecting sites. The map of circled major sources may be used to show areas that are not affected by major sources for specific wind directions. Figure 23 shows an example. In this case the monitoring agency must select a site within 24 km (15 miles) of its offices. However, the impact zone of the city (City A) extends out 90 km, so the agency must monitor on both sides of the city. The most frequent and second most frequent wind directions, shown in the lower right-hand corner of the figure, are about 120° apart. However, a site directly south of the city is not desirable because of interference from City D. An alternative site slightly to the east of south would still be representative for south winds and less affected by City D. Another alternative site is 180° from the direction for which the first site was selected. Selected regional scale monitoring sites should not be influenced by topographical features. Sites along shorelines, in or at the base of pronounced valleys, near sharp bluffs, or in low-lying areas should be avoided. The topography around the most suitable sites is uniform.

Urban Areas with No Major Point Sources

Some urban areas will have no major sources of PM₁₀ emissions. Because most of the measured IP concentrations come from geological materials, from motor vehicle traffic, or from secondary aerosols formed in the atmosphere (EPA 1981; Watson, Chow, and Shah 1981), this may be the situation in a number of areas for which monitoring is planned. Figures 19 and 20 describe steps that may be used to select monitoring sites in such situations.

The first step is to obtain and analyze traffic and urban development data that can be used to identify potential variations in otherwise homogeneous neighborhood scale patterns of PM10 concentrations. Areas of high traffic density, such as major highways, shopping centers, sports areas, amusement parks, airports, and parking facilities, need to be identified and analyzed. Also, areas that are concentrated sources of particulate matter emissions, such as solid waste handling facilities, unpaved roadways, central business districts, and construction operations, need to be analyzed.

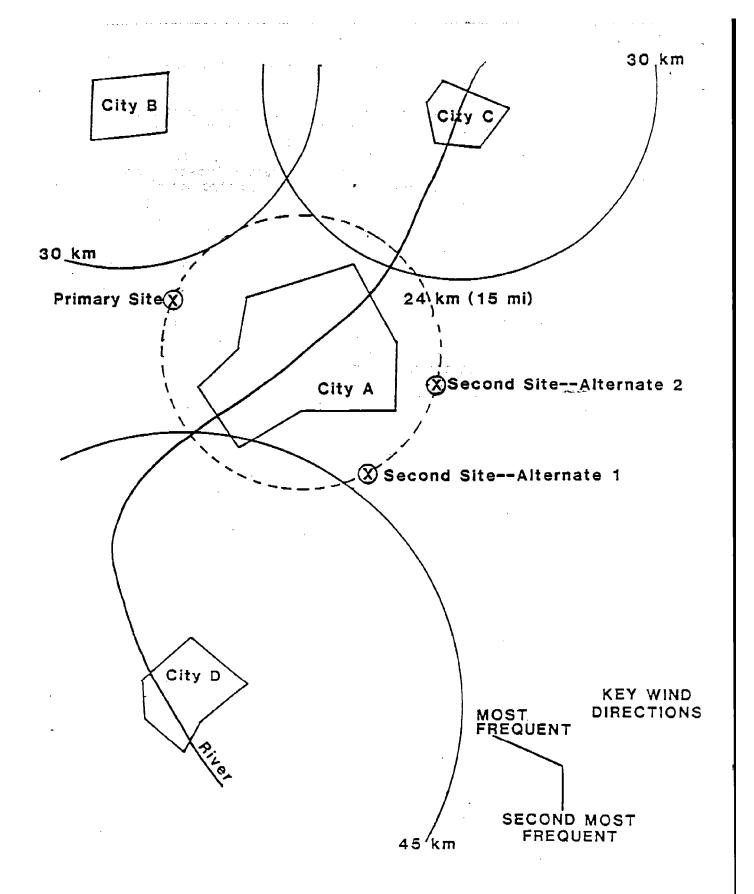


Figure 23. Example of background site selection within 24 km (15 mi) of City A.

Figures 24 through 26 show the model peak concentrations downwind of highways that occur within 15 m of the roadway. Data in Table 12 show the peak concentrations expected downwind of other sources that are centers of intensive traffic-generated emissions. These guides can be used to estimate where the pollution increases above general neighborhood levels will occur, which can be expected in the vicinity of these sources.

On the basis of the magnitudes of the PM_{10} enhancement predicted for all the traffic-concentrated areas and the locations of the source areas relative to the downwind edge of the city for the most prevalent wind direction, a decision must be made on how many monitors will be used to measure the maximum PM_{10} concentration. Unless a single source or source area is clearly more significant than any other, a number of sites should be selected as potential peak concentration monitoring sites. These sites will be representative of micro- or possibly middle scale areas. The monitoring site should be located as close to the source as possible without infringement or interference from the source. The most suitable sites are within 5 to 15 m of the sources on the downwind side of the prevailing wind direction. It is usually not practical to locate a site less than 5 m from a source. Generally, one site is sufficient for each source area.

Neighborhood sites are needed to represent the areas that encompass or surround the peak concentration sites. Due to variations in the type and intensity of land uses throughout an urban area, a large metropolitan area may be characterized by well over 1000 different neighborhoods. The process of identifying and classifying all neighborhoods in a metropolitan area in terms of their potential PM₁₀ air quality levels is a worthwhile effort for air pollution control planning purposes. The use of monitoring or modeling data is the most satisfactory way to making such classifications. However, it is also possible to characterize neighborhoods in a qualitative fashion by preparing a detailed emission inventory that identifies the spatial distribution of emissions from the many indirect and fugitive sources of PM₁₀.

By examining the locations and magnitudes of these sources in relation to the climatology of wind direction frequencies, one can rank neighborhoods in terms of their expected levels of high PM $_{10}$ concentrations. Neighborhoods that encompass the middle or microscale areas that are expected to contain high concentrations are clearly high priority neighborhoods for monitoring sites. One or two neighborhoods adjacent to the maximum concentration neighborhoods are desirable secondary sites. A third category of monitoring sites includes neighborhoods that are of special interest because of large population density; because of rapid growth expectations; or because of a highly sensitive population such as elderly (e.g., nursing home), ill (e.g., hospital), or young (e.g., day care center).

Sites in the third category of interest may also meet the second category of interest. There are no firm rules to determine how many sites to monitor. Each monitoring jurisdiction must determine what its priorities are and how far down the priority list of potential sites it is able and willing to go.

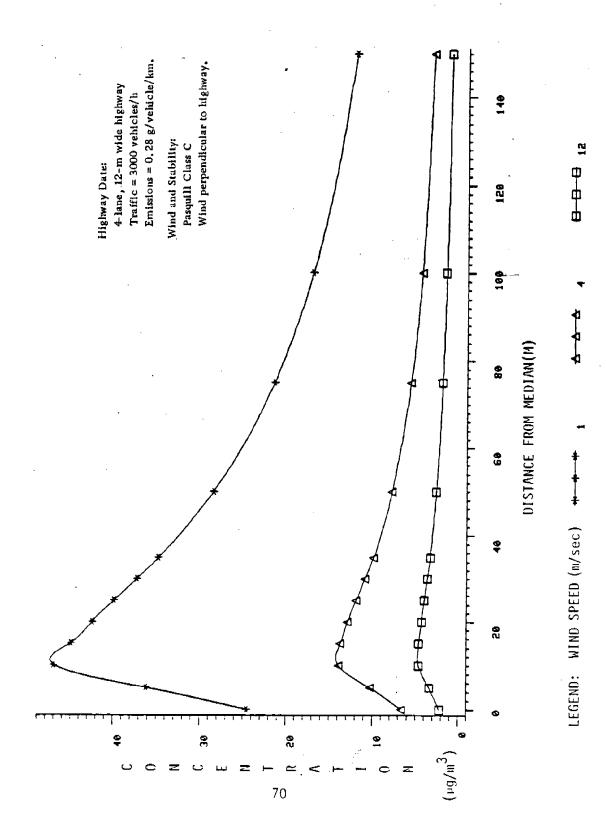


Figure 24. Concentration as a function of wind speed, computed using HIWAY2 model.

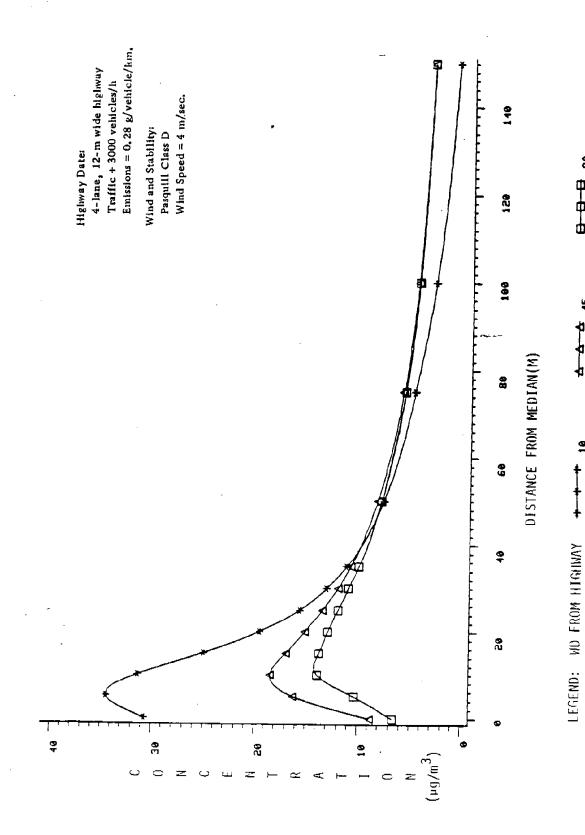


Figure 25. Concentration as a function of wind direction, computed using HIWAY2 model.

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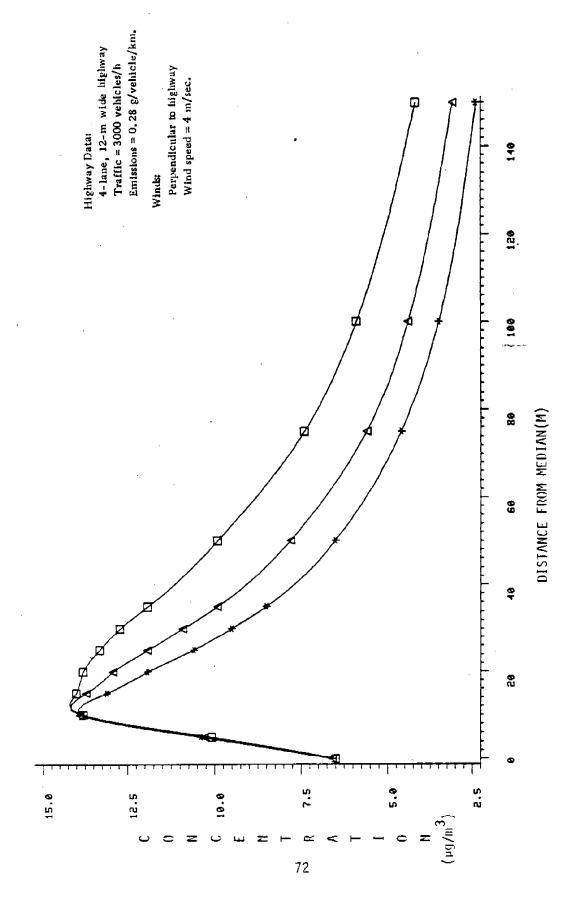


Figure 26. Concentration as a function of stability class, computed using HIMAY2 model.

LEGEND: PASQUILL STABILITY + + + c

TABLE 12. MAXIMUM CONCENTRATIONS NEAR DOWNWIND EDGE OF TYPICAL URBAN AREA SOURCES

Type Source	Typical Maximum 24-hour Concentration (ug/m ³)	References	
Urban Expressway (1)	85	Burton and Suggs 1982	
Street Canyon (2)	45	Ingalls 1981	
Parking Garage* (3)	45	Ingalls 1981	
Roadway Tunnel (2)	650	Ingalls 1981	
Shopping Mall (4)	80	Ingalls 1981	
Sports Stadium* (4)	10	Ingalls 1981	

^{*} Very high short term concentrations may occur near this source.

(3) Based on model estimates and an emission rate of 0.085 g/min.

⁽¹⁾ Based on observed upwind-downwind differences in IP over 14 hours, corrected to 24 hours and PM₁₀.

⁽²⁾ Based on a 24-hour average to peak ratio of 0.5, a vehicle emission rate of 0.28 g/km, and a peak traffic flow of 3000 vehicles/hour.

⁽⁴⁾ Based on CO observations of 2.5 ppm (24 h) for shopping centers, and 22 ppm (15 min) for sports stadiums, and ratio of PM₁₀ to CO emissions of 0.0286.

Table 13 illustrates a rationale for selecting 15 sites. In this example, four neighborhoods are identified that potentially have high micro- and middle scale PM_{10} levels. The neighborhoods that border on a neighborhood containing high concentrations are also expected to have a chance of exceeding the NAAQS for PM_{10} . As a result, two sites in adjacent neighborhoods will be selected. There are also three neighborhoods that contain health care treatment facilities with persons who are highly sensitive to air quality. After discussions with various officials responsible for providing funds for air monitoring operations, a decision is made to put monitors at 15 sites.

TABLE 13. EXAMPLE DETERMINATION OF THE NUMBER OF MONITORING SITES IN A METROPOLITAN AREA*

Priority	Type of scale for PM ₁₀	Recommended number of sites	(X) Number of areas	(=) of	Number sites
1	Includes selected micro- or middle scale site	1	4	مديد	4
2	Adjacent to major source area	2)			8
3	Special interest	1	3	Total	<u>3</u> 15

^{*} This case was selected to be representative of a city with a population of 500,000 and four major source areas. Smaller cities and cities with fewer source areas may require fewer monitoring sites.

Each neighborhood selected for monitoring must be reviewed carefully to identify areas containing micro- or middle scale PM₁₀ effects. Neighborhood scale sites must be selected to avoid these areas. The data presented in Tables 14 through 16 identify the distances to which middle scale effects extend from the types of sources associated with PM emissions. These distances should be shown as circles around sources in neighborhoods selected for monitoring.

TABLE 14. SIGNIFICANT IMPACT DISTANCES OF SMALL GROUND-LEVEL AREA SOURCES

Area (m x m)	Emission rate (kg/km²/day)	Maximum downwind distance (km) with significant impact*
250 x 250	10 102 103	0.25 1.0 5
500 x 500	10 10 ² 10 ³	0.6 2.5 14
$10^3 \times 10^3$	10 102 103	1.4 7 45

^{*} Based on 24 $\mu g/m^3$, F stability class and 2 m/sec wind speed. Estimated using Workbook of Atmospheric Dispersion Estimates (Turner 1970) by treating source as a point. This worst case situation is expected to produce a 24-hour concentration of 6 $\mu g/m^3$.

TABLE 15. SIGNIFICANT IMPACT DISTANCES OF HIGHWAYS

Average daily traffic (veh/day)	Maximum downwind distance (km) with significant impact*
100,000	0.22
50,000	0.11
25,000	0.05
15,000	0.02
12,000	0

^{*} Based on 6 ug/m³, Pasquill stability class D, and wind speed of 2 m/sec at 45 degree angle with highway. Estimated using EPA HIWAY2 model and vehicle emission rate of 0.28 g/km. Because concentrations downwind of highways are not sensitive to variations in wind direction, the worst case 24-hour concentration is based on a persistent worst case 1-hour concentration. This allows the effect to be comparable with worst case effects from elevated points (Table 16) and small areas (Table 14).

TABLE 16. SIGNIFICANT IMPACT DISTANCES OF ELEVATED SOURCES

Effective plume height (m)	Emission rate (kg/hr)	Critical Pasquill stability class	Maximum downwind distance (km) with significant impact*
30	30 10 3	c	3.3 1.7 0.9
100	100 30 10	A	1.2 0.8 0.5
300	100	A	1.2

^{*} Based on 24 µg/m³ and 2 m/sec wind speed. Estimated using Workbook of Atmospheric Dispersion Estimates (Turner 1970). This worst case situation is expected to produce a 24-hour concentration of 6 µg/m³.

Monitoring Isolated Major Sources in Flat Terrain

Figure 20 suggested steps to be followed in selecting monitoring sites near an isolated major source. A distinction must be made between sources with the principal emissions from a tall stack and sources with the principal emissions from ground level. For ground-level sources, the maximum concentrations will occur immediately adjacent to the source in the most prevalent downwind directions from the source. Wind observations will easily identify the most suitable siting areas. Additional monitors may be used to help define the extent of the area near the source that has high concentrations and the neighborhood scale level of PM10 in the vicinity of the source. Two types of information can be helpful in determining the extent of the high impact area: (1) the relative concentration isopleths from the EPA (1970) Workbook of Atmospheric Dispersion Estimates and (2) annual wind direction frequency statistics published by the National Climatic Center (see Appendix A).

It is easily seen from the Workbook data that the peak concentration falls off rapidly with distance for ground-level sources. The peak concentration 100 m from the source drops by a factor of 10 at a distance of 40 km from the source for all stability conditions. The more stable the atmosphere, the more slowly the peak concentration drops with increasing distance from the source. The Workbook curves show that even for very stable conditions (Pasquill Class F), the peak concentration drops by a second factor of 10 within 1600 m from the source. These data show the microscale influences within 100 m of the source are at least 10 times greater than the middle scale influences from 100 to 500 m from the source. If there is public exposure within 100 m, it is important to locate a monitor there. Middle scale monitoring sites within 500 m of the source are desirable in each prevailing wind direction. One of the middle scale sites should be downwind for the wind direction that occurs most frequently with stable conditions and low wind speeds. A Star climatology analysis for the closest weather observing station maybe used to determine this direction (see Appendix A).

If the primary emissions are from a tall stack, the highest ground-level concentrations will be away from the source. Detailed manual computational procedures for estimating the magnitude and location of the maximum impact of tall stack emissions are given in Volume 10 of the EPA Guidelines for Air Quality Maintenance Planning and Analysis (Budney 1977). Figures 27 and 28 (taken from Budney 1977) show how the distance to the maximum short-term concentration varies with the effective height of the exhaust gas plume and atmospheric stability. Figure 27 treats sources in rural terrain, and Figure 28 treats sources in urban terrain. Budney's Guideline describes a method of estimating the effective height of the source. Because the PM_{10} monitors will observe 24-hour and annual mean concentrations, the large variation in distance to the maximum concentration with variations in atmospheric stability class must be taken into account in selecting a site. It may be noted in Figure 27 that the maximum concentrations occur with the greatest instability (i.e., Class A). Therefore, it is important to site a monitor close to the source where the maximum contributions will occur under unstable conditions. As shown by Figure 27, this will be as close as 100 m to a source with a 20 m $\,$ effective height and as far as 800 m downwind of a source with a 300 m effective height.

Another important factor in selecting a site is the persistence of the wind direction over the observation period. Because the wind direction is highly variable under unstable conditions and because persistent wind directions are generally associated with neutral (Class D) stability conditions, a good strategy is to select a second monitoring site at a distance associated with the peak for neutral stability. The distance downwind to the peak concentration will vary from about 350 m for an effective height of 20 m to between 15 and 20 km for an effective height of 300 m.

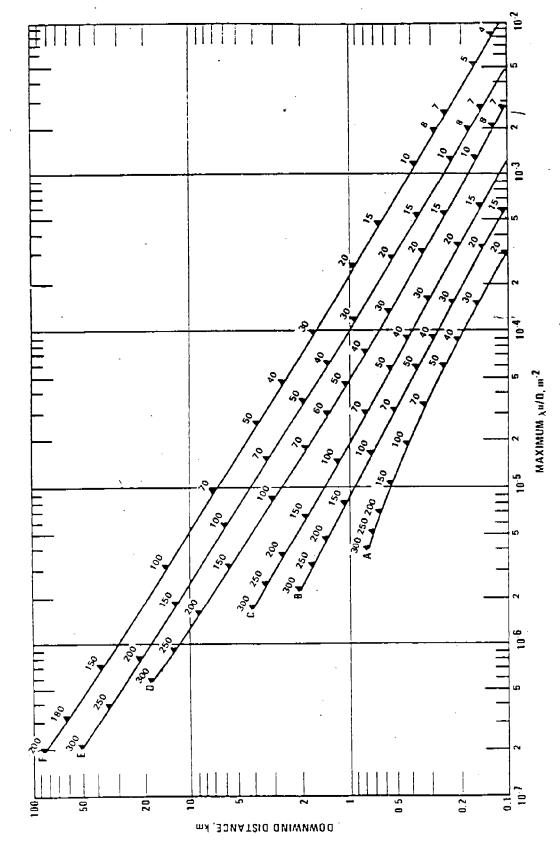


Figure 27. Downwind distance to maximum concentration and maximum relative concentration (χ_u/Q) as a function of Pasquill stability class and effective plume height in rural terrain (Turner 1970)

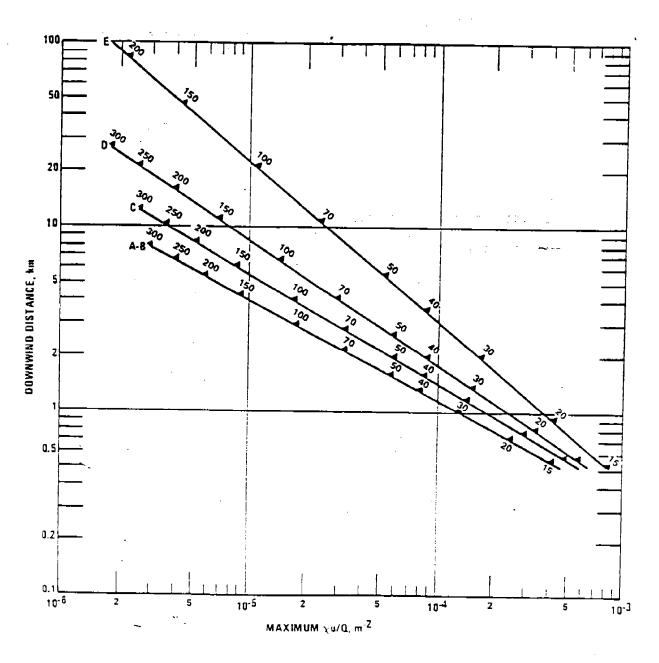


Figure 28. Downwind distance to maximum concentration and maximum $\chi u/Q$ as a function of stability class and effective plume height in urban terrain (Budney 1977).

The peak concentration will be sharp, with high concentrations falling off rapidly with distance from the peak, when the peak is close to the source. This is a middle-scale effect, and the maximum impacts will be observed over an area within 200 to 300 m of the peak. The frequency of wind directions associated with only unstable conditions should be taken into account in selecting sites for observing the middle-scale peak.

When selecting a site to observe concentrations from a tall stack (effective height of 100 m or more) during persistent wind conditions (and neutral stability), the concentrations will fall off gradually with distance from the peak. The impacted area will be on a neighborhood scale, with high concentrations (within 25 percent of the peak) occurring at distances of 2 km from the peak when the effective height is 100 m and to distances of 10 km when the effective height is 300 m. Wind direction frequencies associated with neutral conditions should be used to site monitors. It may be noted that there is a large area within which to select a site.

Wind observations from remote sites (e.g., a regional airport) are very useful for selecting neighborhood-scale sites. When selecting a middle-scale site, it is necessary that the wind observations be representative of the very small scale area in the vicinity of the site. In the next section, topographical influences are discussed that may make wind observations unrepresentative. Suggestions are made for taking the local influences into account in selecting monitoring sites.

Monitoring Isolated Major Sources in Complex Terrain

There are a number of situations in which the complexity of the terrain in the vicinity of a major source will influence how pollutants are distributed in the nearby vicinity. These influences must be taken into account in siting monitors if the observations are going to achieve their objectives. Available meteorological observations may not be adequate to desribe the effects, especially if they are taken from a single site. In particular, the effects of elevated terrain, coast lines, and urban structures need to be taken into account. The air flow characteristics in the vicinity of these types of terrain were discussed in Section 4. Suggestions are given here for using the topographical characteristics of an area to select monitoring sites and to modify the site selection guidelines for flat terrain.

Typical influences due to elevated terrain include two-sided boundaries such as a valley and one-sided boundaries such as a mountain range or a pronounced bluff. Air flow in a valley is subject to nighttime drainage down the slopes and along the valley floor, to upslope covection and fumigation during the day, and to channeled flow when strong winds blow diagonally across the valley. Near one-sided boundaries, emissions on the downwind side of a ridge or hill may become entrapped in the turbulent wake flow downwind of the ridge, or separated from ground-level when overshoot separation flow occurs over the ridge. Emissions near either one-sided or two-sided terrain boundaries may impact the terrain under very stable conditions with the flow

directed towards the elevated terrain. Each of these effects produces a pollution impact zone, which is associated with the terrain configuration. Monitoring sites are needed that measure the results of these effects. The following terrain-oriented sites are needed to supplement or replace sites that conform to flat terrain siting selections:

- Down- and up-valley in place of or in addition to downwind of the most prevalent wind directions
- Terrain elevation at the effective height of the source plume or at maximum elevation (if less than effective height) in prevailing downwind directions
- Nearest terrain elevation at effective height of source plume.

Near a lake or ocean coast, there will be an invisible boundary between the air influenced by the temperature of the underlying water surface and the air influenced by the temperature of the underlying land surface. A great difference in the two surface temperatures can significantly alter air flow in the vicinity of the coast line. The two effects that are of interest in selecting sites for monitors are (1) the tendency for the air flow to be perpendicular to the coast and (2) the formation of a vertical circulation with its axis centered on the coast line. The first effect indicates the need for a monitoring site directly inland from a source near the coast. The second effect indicates the need to have sites along the coast on both sides of the source. These sites are to catch the impact of air that initially moves inland, but that subsequently rises, moves back over the water, sinks, and blows back inland at low levels. Under these conditions, pollution moves perpendicular to the apparent ground-level wind observations. The magnitude of the air pollution effect from this recirculation of air over the coast line is difficult to anticipate. It could be an important, controversial contribution to establish. These siting considerations should be taken as supplements to the guidelines given for more uniform terrain situations.

Urban Areas with Major Point Sources

When major point sources of PM emissions are present in an urban area, there is a need to consider the impacts of the point and the urban area sources individually and of their joint overlapped effects. Siting considerations relating to both urban areas and points as individual sources were previously discussed. The overlapped effects can be best identified by considering lines connecting pairs of nearly individual sources. When the connecting lines parallel one of the prevailing wind directions, locations that are downwind of both sources and near the maximum of the second downwind source are likely locations of maximum 24-hour PM₁₀ concentrations. However, the maximum annual mean concentration is likely to be in a location that is central to the individual sources. Such a location will be affected

by different sources at different times, rather than by the simultaneous overlapping of the effects of two or more sources. These two qualitative criteria regarding the impact of overlapping effects can be used to help identify locations that are probably sites of maximum concentrations. These criteria are helpful when a modeling analysis is not available to evaluate the joint effects of multiple sources.

Simple calculations and graphical analysis may be used to apply the above siting criteria for multiple sources. For instance, in deciding which pairs of overlapped source contributions are most significant, the relative emission sites and distances between sources should be taken into account. The contribution of a source to the PM10 concentration at any location is directly proportional to the emission rate and inversely proportional to the distance from the source. Although the distance relationship is a complex function of atmospheric stability conditions and the effective height of the emissions, the distance effect is most frequently very nearly proportional to the inverse square of the distance. For the purpose of evaluating the importance of overlaps from the sources, the following relationship can be used:

$$A = \frac{E}{D^2}$$

where A = Relative contribution from second source

E = Emission rate (second source)

D = Distance to second source.

To illustrate the use of this relationship, consider a major urban freeway with a nearby source only 0.5 km away that emits 10 lb/hr. The overlap contribution from the source will be more important than any other source emitting $100\ lb/hr$ or less at a distance of 1.6 km or more away, since

$$A_1 = \frac{10}{(0.5)^2} = 40$$

$$A_2 = \frac{100}{(1.6)^2} = 39$$

A good way to define the scale and locations of the effect of overlapped sources is to construct a representative graph of peak concentrations versus distance downwind of the second source. This can be done quite easily by the use of the EPA Workbook of Atmospheric Dispersion Estimates (Turner 1970) or

Volume 10 of the EPA Guidelines for Air Quality Maintenance Planning and Analysis (Budney 1977). The following steps may be used:

- 1. Pick a representative stability condition (e.g., C stability) and find the appropriate xu/Q versus distance graph.
- 2. For the larger of two overlapping sources, use the selected graph to find a dozen pairs of xu/Q and distance values that straddle the peak xu/Q value, and multiply the xu/Q values by the emission rate to get $(xu)_1$ values.
- 3. Add the distance (D) between the two sources to the distances read in step 2 and read a new χ /Q value from the graph for each new distance.
- 4. Multiply the second set of xu/Q values by the second source emission rate to get $(xu)_2$ values.
- 5. Add the two sets of xu values together and plot the sum as_a function of the initial distance (without D added).
- 6. Repeat steps 2 through 5 for additional distances to make the curve complete.

Table 17 shows a sample work table for use with the above steps. The procedure may be repeated for more than one stability class to help identify a range of distances from the source within which the maximum concentrations will occur. The buildup and fall off of concentration with distance will help identify the distance scale that the combined concentrations will affect.

TABLE 17. SAMPLE WORK TABLE FOR OVERLAP EFFORTS

Distance from larger			Distance from smaller			(Xu)1
source (x)	(xu/Q) ₁	$(xu)_1$	source (x+D)	(Xu/Q) ₂	(Xu) ₂	(Xu) ₂

This procedure is expected to be adequate for most monitor siting purposes. However, the graphs referenced above do not include any effects of particle removal due to fallout or other atmospheric processes. Actual concentrations may decrease more rapidly with downwind distance than is represented by these curves. More accurate graphical representations of the relationship may become available in the future and should be used when appropriate.

When considering sites to measure long-term concentrations that include contributions from many sources, a simple numerical evaluation procedure may be used to help select the best sites. Over a long-term period, both the distance from the source and the frequency with which the wind blows from each source to the potential monitoring site must be taken into account. The following simple source weighting function takes these two effects into account:

$$B = \sum_{i=1}^{N} \frac{E_i f_i}{(Di)^2}$$

where B = Monitoring site pollution index

 E_i = Source i emission rate

 f_i = Relative frequency with which wind blows from source i

to the monitoring site

 D_i = Distance from source i to monitoring site N = Number of urban area and major point sources.

This site evaluation equation may be used to rank alternative monitoring sites. The best way to perform the site evaluation process is to plot the major urban area and major point sources on a map. A number of locations in the middle of the sources and close to or downwind of the larger sources may be selected as potential monitoring sites. The evaluation equation may then be used to score the relative pollution levels expected at each potential site. The highest score would indicate the site most likely to measure the highest PM₁₀ concentration.

SELECTION OF MONITORING SITES

Number and Locations of Monitors

The preceding steps have been concerned with developing a pattern of PM_{10} air quality that occurs in an area of concern for which monitoring is planned. This may be an area administered by an air pollution control agency or an area impacted by a particular source. In either case, there are

three types of information regarding the patterns which are of interest, including:

- Maximum PM₁₀ concentration
- Background PM₁₀ concentration
- ullet Area impacted by significant PM $_{10}$ concentrations.

Significant PM₁₀ concentrations may be levels associated with air quality standards, PSD increments, specific increments above background levels, or other criteria of interest. There is another type of site that does not involve a selection process (i.e., sensitive sites of special interest). In a simple pattern, there will be one maximum and a single regularly shaped contour that defines the area impacted by significant concentrations. Complex patterns have two or more peaks that may or may not lie within a single closed contour of impacted areas of interest. Unless one peak is much higher than the others, two or more peak areas will need to be monitored.

The number of monitors needed to define impacted areas will include a minimum of two and may include six or more depending on how large, how complex and how definitive the impacted area is. A single, well-sited monitor, located well away from any nearby sources or source areas, may be adequate for determining background concentrations. If it is impractical to locate a monitor far away from nearby sources, it may be desirable to select two nearby monitors, one or more of which is measuring background concentrations on any given day, depending on wind direction. Because \mbox{PM}_{10} concentrations are measured over 24-hour periods and because the wind direction is frequently variable over a 24-hour period, this is a less desirable option than a single, well-sited monitor.

In planning and revising air monitoring plans, it is important to bear in mind that the need for monitoring data is dynamic and will change from year to year. Once the nature of the air quality pattern for $\mbox{\rm PM}_{10}$ concentrations has been established or verified, fewer stations are needed to evaluate general ambient conditions and trends. This is especially true for areas where the ambient levels are well within acceptable limits and there is no significant impact area. Reducing the amount of resources allocated to fixed monitoring stations will allow resources to be reallocated to meet other special purpose monitoring needs.

Previous monitoring and modeling provide a first estimate of the PM_{10} air quality patterns, but a large amount of uncertainty may still exist regarding both the shape and the magnitude of the pattern. Therefore, some monitoring resources should be allocated to verifying the assumptions made regarding the pattern. Two forms of monitoring are recommended for this purpose, including temporary sites and mobile monitoring. This type of monitoring is most effective when it is used in conjunction with modeling results to confirm or deny the influence of specific sources on air quality levels. An example of appropriate use of this type of monitoring is to

establish the validity of a kink or a bulge in the air quality pattern due to the influence of a specific nearby source or source area. Modeling results could be obtained to show the expected contribution of specific sources to the bulge. Air monitoring results along with appropriate meteorological data could be used to establish the validity of the influence. A temporary monitor could be moved from one location to another to investigate the validity of a number of these influences. The monitoring results would increase confidence in the modeling results or provide the basis for either model improvements or selection of a more accurate model.

Mobile monitoring can also be used to help establish the influence of specific sources. Mobile monitoring is effective when it is used to identify peaks in concentrations during crosswind sampling traverses downwind of large elevated point sources. Another effective use of mobile monitoring is to encircle area sources in order to establish concentrations upwind and downwind of suspected significant sources of ground-level fugitive emissions. A limitation in mobile monitoring is the need to use a continuous type of analyzer. Continuous measurements of PM will necessarily be based on physical measurement other than the weight of size-selected particulate matter collected on a filter. As a result, it will be necessary to correlate the mobile measurements with fixed station measurements before interpreting the mobile measurement data. Some guidelines on ways of making these correlations are provided in the Guidelines for PM-10 Episode Monitoring Methods (Pelton 1982).

Specific Site Selection

Once a general area for a monitoring site has been selected, it is necessary to select a specific location for the sampling operation. The intake for the monitor must be representative of the siting area, as close to the breathing zone as possible, and not biased abnormally high or low by influences which are only representative of the probe intake. The nature of biasing influences is documented in CFR 40 Part 58 and includes the following:

- Chemical reactions due to the air stream passing near reacting surfaces
- Unusual micrometeorological conditions
- Vegetation that serves as a pollutant sink
- Undue influence from nearby small sources (e.g., incinerator or furnace flue)
- Shielding influences from nearby obstructions.

Based on the consideration of these factors, the following guidelines for siting problems were promulgated in CFR 40, Part 58:

- 2-15 m above ground, as near to breathing height as possible, but high enough not to be an obstruction and to avoid vandalism
- At least 2 m away horizontally from supporting structures or walls
- Should be 20 m from dripline of trees
- Should not be near furnace or incinerator flues
- No nearby obstructions to air flow due to buildings, structures or terrain, at least in directions of frequent wind.

These guidelines were provided for TSP but are equally applicable to PM10.

INSTALLATION AND FOLLOWUP

Each time a monitoring site is established, a documented description of the site is established. This record will help in the interpretation of results obtained from the site and in the evaluation of the need for changes. The following information is useful in documenting a site with regard to effects on measured PM₁₀ concentrations:

- Exposure diagram
 - Horizontal depiction showing location relative to nearby streets, buildings, and other significant structures, terrain features, or vegetation
 - Vertical depiction showing location relative to supporting structures, including buildings, walls, etc.
- Height of sampling intake above ground level
- Microinventory map showing locations of roads (with traffic counts), open fields, storage piles, and any visible emissions within 500 m of sampler
- List of all inventoried point and area sources within 1.5 km of sampler and all major point sources within 8 km of sampler

- Make and model of PM10 monitor
- Types of meteorological and other air monitoring equipment operated at the site.

Once a monitoring site is selected and approved, the above site information should be compiled. As soon as it is practical, data collected from the site should be reviewed and scrutinized to determine that they do not contain undue influences from nearby sources. The suggestions for analyzing single-station air quality records, presented earlier in this report, should be used to evaluate the observations.

SECTION 6

EXAMPLE STUDY

To illustrate and test the ideas for selecting monitoring sites that were described in Section 5, TSP data for the City of Baltimore and surrounding areas for 1980 and 1981 are listed in Table 18. Figure 29 shows the locations of monitoring sites within the city limits; Figure 30 shows monitoring site locations outside the city limits.

For the purposes of this example, it is assumed that the State of Maryland and the City of Baltimore will cooperatively operate monitoring stations in the city for the following objectives:

- Evaluate progress in meeting and judge the attainment or nonattainment of NAAQS
- \bullet Develop and revise as necessary the Maryland Implementation Plan for controlling PM_{10}
- Provide data to EPA to meet national monitoring needs and to evaluate the State's management of air quality
- Provide data for model research and development
- Support enforcement activities
- Provide the public with information on air quality exposure and trends
- Provide data to identify and document episode exposure situations.

The annual mean concentrations for 1980 and 1981 are plotted in Figures 31 and 32. Isopleths are also shown to help interpret the patterns indicated by these data. The locations of the eight major point sources with particulate matter emissions in excess of 100 tons/yr are also shown and identified by number. The estimated emission rates for these sources are listed in Table 19. Fugitive emissions shown by squares in the air quality maps are listed in Table 20.

The maximum 24-hour concentration of TSP that were measured during 1980 and 1981 are shown in Figures 33 and 34. The 1981 pattern is based on 15 observations, while the 1980 pattern is based on 10 observations. The patterns of maximum concentration are quite different between the 2 years. The tongue of

TABLE 18. HI-VOL MEASUREMENTS OF TSP IN THE VICINITY OF BALTIMORE (MARYLAND AIR MANAGEMENT ADMINISTRATION 1980, 1981)

		Geometr	ric mean	Maxi (6-day	mum cycle)
Si	Site, county		1981	1980	1981
35.	Fire Department Headquarters, City	82	70	284	203
38.	NE Police Station, City*	54	48	138	129
39.	NW Police Station, City*	69	56	275	122
40.	SE Police Station, City*	81	68	269	166
41.	SW Police Station, City*	65	55	201	135
42.	Fire Department #10, City		88		325
44.	Fairfield, City	89	89	206	310
47.	Canton Pier #4, City**		$(141)^2$		(575)2
48.	AIRMON-02, City	·	67		146
49.	Fire Department #22, City**	82	(85) ²	222	$(165)^2$
50.	Ft. McHenry, City	103	89	195	231
51.	Holabird Elementary School, City**	$(72)^2$	71	(175) ²	161
52.	Westport, City	93	71	178	140
53.	Canton Recreational Center, City**		(75)2		(176)4
54.	I-95, City**	(73)3	73	(133) ³	155
23.	Garrison, County	49	47	94	93
26.	Catonsville, County	47	46	86	112
28.	Essex, County	64	61	134	136
29.	Padonia, County	67	60	183	114
33.	Chesapeake Terrace Elementary School, County	66	60	147	140
34.	Sollers Point	79	80	145	176
18.	Linthicum, Anne Arundel County**	(56)2		(81)2	
20.	Glen Burnie, Anne Arundel County	68	61	132	125
23.	Riviera Beach, Anne Arundel County	60	58	85	137

^{*} Operated on a 3-day cycle, rather than a 6-day cycle.

^{**} Values in parentheses represent only two or three quarters.

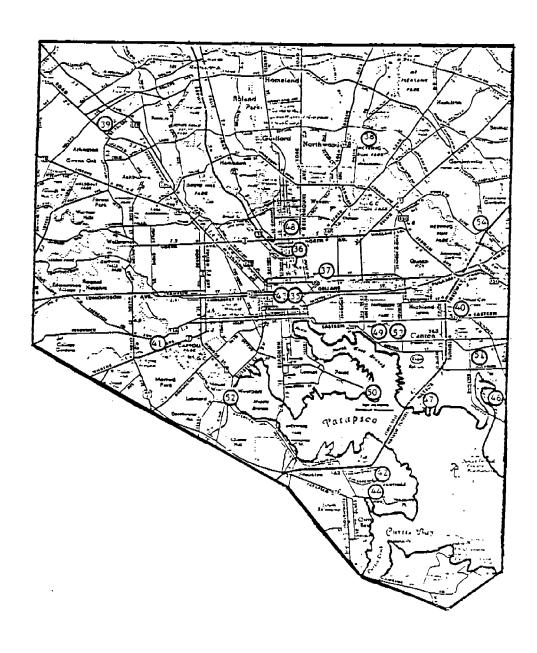


Figure 29. TSP monitoring sites in Baltimore City.

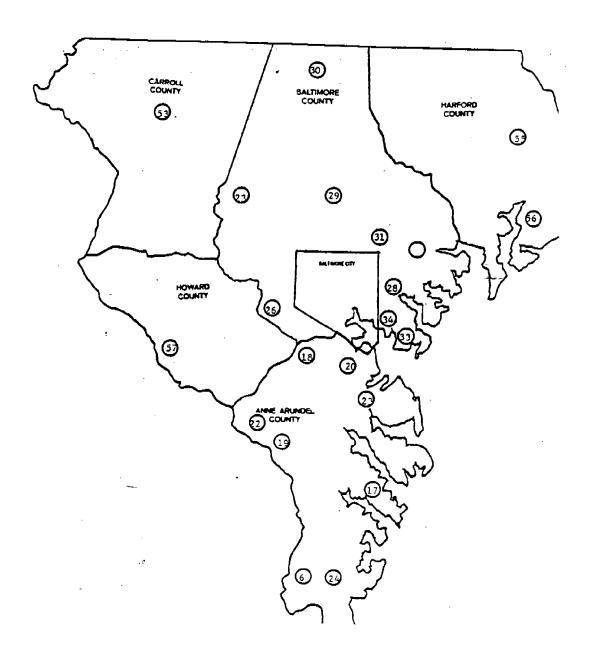


Figure 30. TSP monitoring sites in the Baltimore AQCR, excluding Baltimore City.

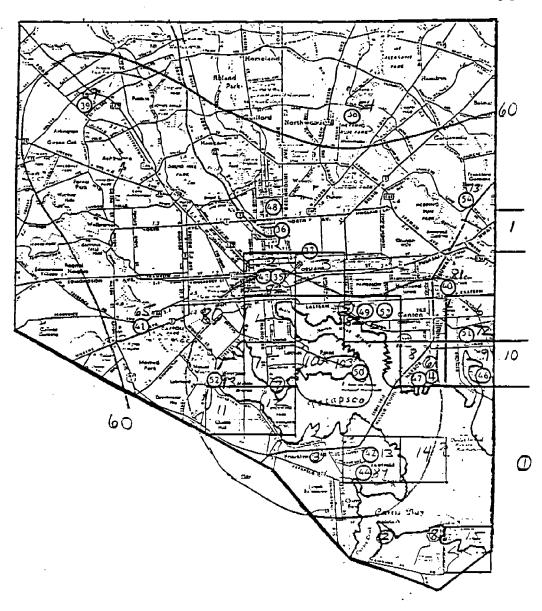


Figure 31. Annual mean TSP concentration for 1980.

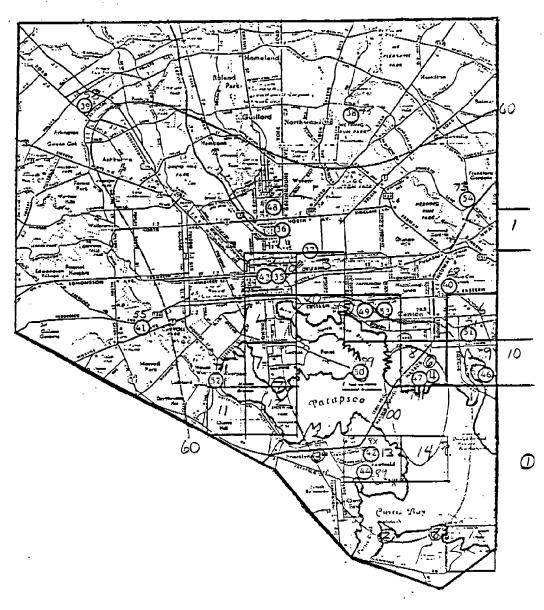


Figure 32. Annual mean TSP concentration for 1981.

TABLE 19. TSP EMISSIONS BY EIGHT LARGEST POINT SOURCES IN BALTIMORE CITY

Number	Name	Emissions (tons/year)	Туре
1	BG&E	181	Fuel burning
2	Davison Chemical	133	Process
3	General Refractory	116	Process
4	Carton Elevator	1,475	Process
5	Allied Chemical	145	Process
6	National Gypsum	126	Process
7	Louis Dreyfus	2,193	Process
8	U.S. Gypsum	1,612	Process

TABLE 20. FUGITIVE EMISSIONS BASED ON 1977 SURVEY (Schakenbach and Koch 1978)

Area identification	Emission rate (tons/day)	Principal sources
1 2	11.7 8.0	Dirt roads
3	2.2	Dirt roads, construction sites Dirt and gravel roads
4	4.1	Dirt and gravel roads
5	2.2	Dirt and gravel roads
6	7.3	Dirt roads
7	2.4	Dirt roads, construction sites
8 .	2.6	Dirt and gravel roads
9	10.9	Dirt and gravel roads
10	2.7	Dirt and gravel roads
11	1.8	Gravel roads
12	1.7	Construction sites
13	3.8	Storage piles, gravel roads
14	4.1	Gravel roads
15	2.1	Gravel roads

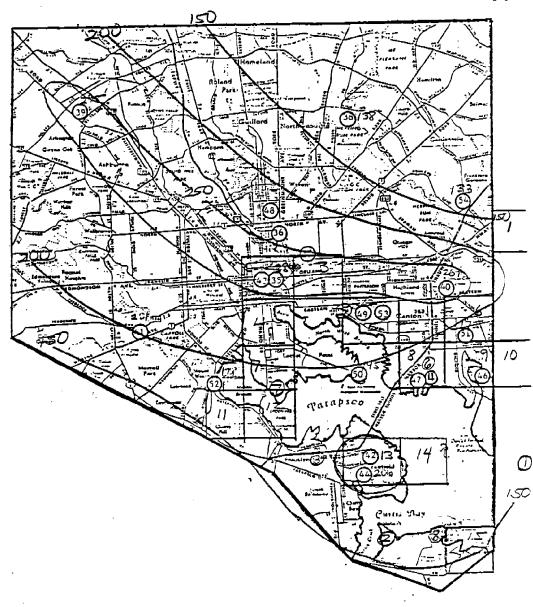


Figure 33. Maximum 24-hour TSP concentration for 1980.

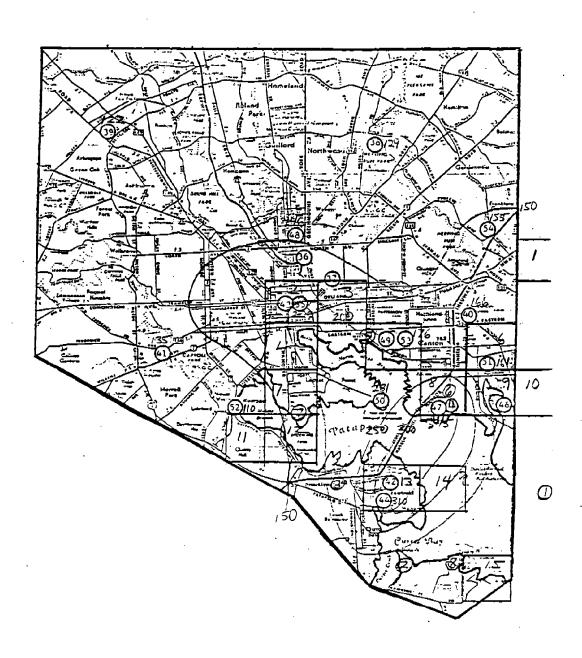


Figure 34. Maximum 24-hour TSP concentration for 1981.

high concentrations shown for the 1980 data is not confirmed in 1981. It is possible that the two high observations to the east and northwest ends of the tongue were not properly sited and showed unrepresentative local influences. The 1981 pattern for maximum 24-hour concentrations is more compatible with the two annual mean patterns, showing a primary peak around the open harbor area and a secondary peak over the primary central city area just west of site 35.

The TSP monitoring data indicate a core area of high concentrations centered on the Baltimore harbor region. The highest point and area source emissions of particulate matter also form a ring around the harbor zone.

Figure 35 is a wind rose showing the frequency of 24-hour mean wind directions with a wind persistence index of 0.85 or greater. (An index of 1.0 indicates a continuous wind direction without variation.) The wind directions with the most frequent occurrence of a persistent wind are west-northwest, west, and northwest. The persistent wind directions closely parallel the orientation of the harbor along the Patapsco River. Therefore, the persistent winds also favor a core of high particulate matter concentrations around the harbor zone. The tongue of high values north of the principal sources shown in the peak 1980 concentrations is not well supported and is not evident in the 1981 data.

PM10 concentrations may be expected to show a flatter pattern with less pronounced peaks than the TSP data. This is because there will be lower contributions from the larger particles released close to local sources. Monitoring sites farther from the local sources will be less affected by the deletion of larger particles and will show smaller reductions. This will result in a smoother pattern.

At least one site in the harbor area is needed to measure the peak PM₁₀ concentrations. Since the area is presently out of compliance with NAAQS for particulates, there will need to be sufficient monitors in the area surrounding the harbor to delineate the general shape of a potential noncompliance area for the new PM_{10} standards. One strategy would be to select locations northwest, northeast, and south or southwest of the harbor area. In view of the potential for high levels of PM10 concentrations, there is a need to inform the public of PM10 exposure levels and trends, to document episode situations, and to support enforcement activities. For these reasons, it is desirable to site at least one and ideally two additional PM $_{
m 10}$ monitors in the harbor area. Once the magnitude of PM₁₀ concentrations relative to PM₁₀ standards has been established, the siting requirements need to be reevaluated. There is also a need for a background monitoring site. There are many suitable sites that are presently monitoring TSP concentrations. Baltimore County Site 23, about 15 km northwest of Baltimore City, is upwind of the persistent prevailing wind directions. Furthermore, TSP measurements made at this site are indistinguishable from TSP measurements made at a site 35 km to the northwest (site 53) in very rural Carroll County (see Figure 31).

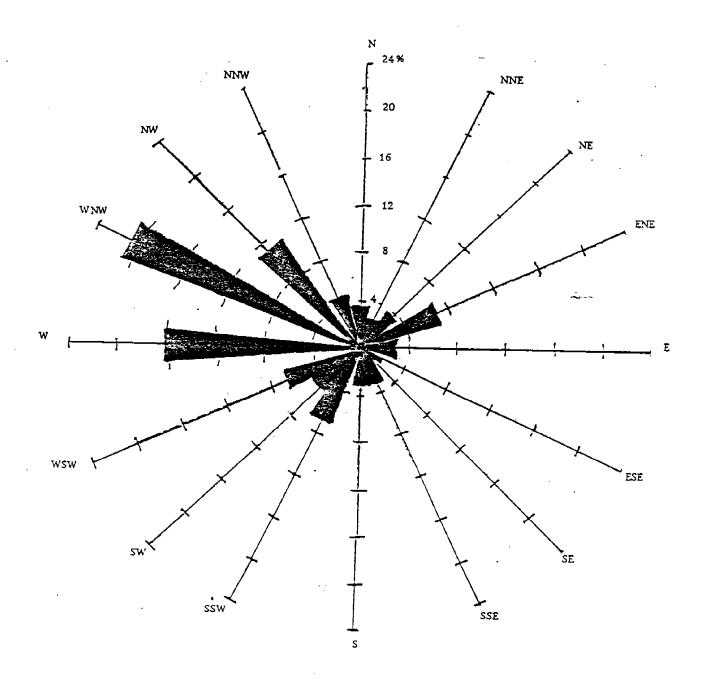


Figure 35. Wind persistence rose for Baltimore-Washington International Airport for 1973-1977 (wind persistence index greater than 0.85) (Pickering et al. 1979).

The preceding discussion describes the development of PM_{10} monitoring network requirements where there is adequate TSP monitoring data to define the shape of the expected pattern of PM_{10} concentrations. In this situation, modeling is not necessary. The subsequent selection of specific monitoring placements require onsite inspection of potential sites and the criteria described in Section 5.

SECTION 7

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APPENDIX A

METEOROLOGICAL DATA TABULATIONS FOR CDM PROGRAM

Cities for which <u>Stability Array</u> (STAR) data tabulations are available are listed alphabetically by date and by city within a state. This list was compiled by Changery, Hodge, and Ramsdell (1977). Additional tabulations may be available since this compilation, and others may be ordered. For assistance on orders contact:

Director National Climatic Center Federal Building Asheville, North Carolina 28801

A-1. EXPLANATION OF ENTRIES

CITY is the city or town name for the location at which the original observations were taken. It may also be the name of a military installation.

NAME-TYPE is usually the airport or field name and/or service which operated the station. If these had changed during the period summarized, the name and/or service valid for the longest portion of the summary is used. A few stations may have no identifying information.

Under NAME, commonly used abbreviations are:

APT - Airport

ATL - Air Terminal

BD - Building

CAP - County Airport

CO - County FLD - Field

GEN - General GTR - Greater

INL - International

MAP - Municipal Airport

MEM - Memorial METRO- Metropolitan MN - Municipal

RGL - Regional TERM - Terminal

Under TYPE, commonly used abbreviations are:

AAB - Army Air Base AAF - Army Air Field

AAF - Army Air Field
AAFB - Auxiliary Air Force Base

AEPG - Army Energy Proving Ground

AF - Air Force

AFB - Air Force Base AFS - Air Force Station

ANGB - Air National Guard Base

ASC - Army Signal Corp

CAA - Civil Aeronautics Administration EAA - Federal Aviation Administration

FSS - Flight Service Station

LAWR - Limited Airways Weather Reporting (Station)

MCAF + Marine Corps Air Facility
MCAS - Marine Corps Air Station

NAAF - Naval Auxiliary Air Facility NAAS - Naval Auxiliary Air Station

NAF - Naval Air Facility
NAS - Naval Air Station

NAU - Naval Air Unit NF - Naval Facility

NS - Naval Station
PG - Proving Ground

SAWR - Supplementary Airways Weather Reporting (Station)

WBAS - Weather Bureau Airport Station

WBO - Weather Bureau Office

<u>ST</u> is a two-letter code identifying each of the fifty states.

WBAN # refers to the five-digit number identifying stations operated by United States Weather Services (civilian and military) currently or in the past. A few stations have had no number assigned.

 $\underline{\text{WMO}}$ # refers to the five-digit block and station numbers assigned to U. S. stations as authorized by the World Meteorological Organization. Many stations with a WBAN # will have no corresponding WMO number.

<u>LAT, LONG</u> are the latitude and longitude of the station in degrees and minutes. If the station changed coordinates during the period summarized, the location reflects the site with the longest record.

<u>ELEV</u> is the elevation (above sea level) of the station in meters. Reported station elevation was used if the barometric height above sea level was not available. If an elevation change occurred during the period summarized, the elevation reflects the station height for the longest period of record.

PERIOD OF RECORD is the first and last month-year of the summarized period. As an example, 01 38 - 12 44 is read as January 1938 through December 1944.

SUMMARY TYPE identifies each summary according to its format. Each format is similar to one of the 16 types presented in detail beginning on page I-13.

SUMM FREQ is the summary frequency or the time period in which the summarized data are presented. Abbreviations used are:

- M Monthly. Data for each calendar month combined and presented on a monthly basis.
- S Seasonal. Data for the months December through February of the period of record are combined into a winter season, summarized and presented on a seasonal basis. The months March-May, June-August, and September-November are similarly summarized.
- A Annual. All data for the period summarized together.
- MA Monthly and Annual.
- SA Seasonal and Annual.
- MS Monthly and Seasonal.
- MSA Monthly, Seasonal, and Annual.
- IYM Individual Year-Month. Data are presented for individual months of record.
- SP Special Period. The special period presented is described further in the given summary's Tab #/Remarks column.

TAB #/REMARKS column contains additional identifying or explanatory information. Many of the summaries produced by the Climatic Center and Air Weather Service for a specific project are identified by a tabulation number. A "T" followed by a 4 or 5 digit number identifies a summary produced by the NCC. Similarly, a "TCL" with a number indicates an AWS summary. Not all summaries can be so identified. This number is provided as an aid in requesting a specific tabulation.

Numbers following or in place of a tabulation number refer to remarks listed beginning on page I-9. These remarks are provided if additional information describing a summary is necessary. Examples are summaries with data for hourly or 3-hour periods, specified hours only, combined stations, etc.

A-2. REMARKS

This is a list of descriptive remarks coded by number in the Tab #/Remarks column of the index. Numbers missing were not used.

- 1. Broken period
- 2. 3-hourly groups
- 3. Day-night
- 4. 0600-1800 LST only
- 5. 10-12 observations per day, all daylight hours
- 6. By hours 00, 03, 06, 09, 12, 15, 18, 21 LST
- 7. See microfilm for broken periods and format
- 8. Includes flying weather conditions
- 9. Part "C" only
- 10. Hours 0600-1200 LST only
- 11. May-November only
- 12. Broken period pre-11/45 data from Point Hope (Stn #26601)
- 13. Broken period by hourly groups
- 14. Less 12/59
- 15. Pre-1939 data from Tin City (Stn #26634)
- 16. Less 12/70
- 17. 0500-1600 LST only
- 18. 2-13 observations daily
- 19. 0700-1900 LST only
- 20. Combined data for Douglas AAF (Stn #23001) for 11/42-11/45 and Douglas Apt (Stn #93026) for 11/48-12/54
- 21. Part "A" only by hourly groups combined data for Kinoman CAA (Stn #93167) for 01/34-12/41 and Kingman AAF (Stn #23108) for 03/43-06/45
- 22. For hours 0800, 1400, 1700 LST only
- 23. Direction and speed by visibility, relative humidity $\geq 90\%$ and/or precipitation, and relative humidity $\geq 90\%$ and no precipitation August, October, and December only
- 24. Part "A" only
- 25. By 2-hourly groups
- Daylight hours only
- 27. September-December only
- 28. By hourly groups
- 29. For 0900-1600 and 1700-0800 LST
- 30. Period 01/37-03/38 for Indio (Stn #03105)
- 31. Precipitation-wind tabulation for April-October
- 32. By day and night hours on microfilm
- 33. Periods: July 15-31, August 1-15 for 1000 and 1400 LST
- 34. No data for 27 months
- 35. See Edwards AFB
- 36. Some data from Paso Robles (Stn #23231)
- 37. All observations by various stability classes
- 38. See Moffett Field
- 39. Also contains a contact wind rose
- 40. Eight directions and calm
- Includes a percentage graph

```
1200 LST observations only
 42.
 43.
       Some missing data
       Contains all weather, precipitation, and visibility \leq 6 miles
 44.
       wind tabulations for day and night hours
 45.
       Also called 94A
 46.
       See Farallon Island SE
       0100-0400 LST
 47A.
 47B.
       0700-1000 LST
 47C.
       1300-1600 LST
 47D.
       1900-2200 LST
 47E.
       0600-2200 LST
47F.
       0700 LST
47G.
       1600 LST
47H.
      0600-0900 LST
47I.
      1600-1800 LST
47J.
      0700-0900 LST
47K.
      1900-0600 LST
47L.
      1000-1500 LST
47M.
      1200-2000 LST
47N.
      0800-2100 LST
47P.
      1100-1300 LST
48.
      Also contains bimonthly summaries
49.
      Located in city file
50.
      Three speed groups
51.
      June, July, August - daylight hours only
52.
      Special tables
53.
      Pre-1944 data from Bolling AAF (Stn #13710)
54.
      Also known as Chantilly, VA, FAA (pre-Dulles)
55.
      See Andrews AFB, MD
56.
      Data for 01/74 from Herndon Apt (Stn #12841)
57.
      See also Cape Kennedy AFB
58.
      Tower data - 8 levels (3-150 m)
59.
      June-August only
      Data for 09/42-09/45 from Carlsbad AAF (Stn #23006)
60.
61.
      Data after 07/53 from Key West NAS (Stn #12850)
62.
      Data thru 1945 from Marianna AAF (Stn #13851)
      Contains 14 months of data from Morrison Field (Stn #12865)
63.
64.
      Contains graphical wind rose
      Tabulated by temperature and relative humidity intervals
65.
65.
      Seasonal by day and night hours
67.
      Closed and instrument weather conditions only
68.
      Less 01/49
69.
      24 observations daily
70.
      8 observations daily
71.
      1 of 3 parts
72.
     Tabulation by day and night hours for May 1 - September 30 and
      October 1 - April 30
73.
      Tabulated for December-March and April-November
74.
```

Data prior to 10/42 and after 10/45 from Sioux City Apt (Stn #14943)

```
For day - clear and cloudy and night - clear and cloudy conditions
75.
      Also contains a ceiling-visibility tabulation
76.-
      0700-1900 LST only
77.
      All weather and 2 relative humidity classes
78.
      Summer season only - 1957 missing
79.
      May, August-November only
80.
      Includes separate wind rose for WSO
81.
      Four speed categories
82.
      Monthly tabulation for 0400 and 1400 LST, seasonal tabulation for
83.
      all observations
      Some data from Presque Isle AFB (Stn #14604)
84.
85.
      Four observations per day
      Semi-monthly periods
86.
      1935 data from Boston WBAS (Stn #14739)
87.
      VFR, IFR, closed conditions
88.
      Pre-03/1952 data from Paso Robles (Stn #23231)
89.
90.
      August 1-15 only for hours 1000 and 1400 LST
91.
      Partial SMOS
92.
      June, July only for hours 2200L - 0200L
93.
      April thru December only
      Less April .1958 and 1960
94.
95.
      January, April, July, and October only
96.
      Winter season only
      Part "C" and "E" only
97.
98.
      36 compass points
99.
      Less October-December 1945 for a 2-hour period after sunrise
      November 1951 substituted for November 1955
100.
      For hour groups 07-09, 10-15, 16-18, and 19-06 LST and all
102.
       hours combined
       For hours 0100, 0700, 1300, and 1900 LST (individual and all
103.
       hours combined)
       Day and night hours, clear and cloudy conditions
104.
       Pre-02/33 data from Albuquerque WBO (Stn #23073)
106.
       Precipitation wind rose tabulation
108.
      All observations by 6 hourly groups
109.
       For ceiling less than 600 feet and/or visibility less than 1-1/2
110.
       miles - also an annual hourly summary
       Also summarized by month-hour for hours 0200 and 1400 LST
111.
       Summarized by days 1-15 and 16 to end of month for day and
112.
       night hours
115A.
       1300 LST
115B.
       0400 LST
1150.
       1000 LST
       1600 LST
115D.
115E.
       2200 LST
       0700 LST
115F.
       0100 LST
115G.
```

Pre-04/32 data from Oklahoma City WBO (Stn #93954)

1900 LST

See Covington, Kentucky

May to October only

115H.

118.

119.

- 120. . Monthly for 1961-63, individual months 1-4/64
- 121. Also contains day and night summaries
- 124. Summary titled Scranton
- 125. See Wilkes-Barre
- 126. December-February for 0730 and 1930 LST only
- 128. Pre-12/44 data from Galveston AAF (Stn #12905)
- 129. Data for 10/62-12/63 for Greenville-Spartanburg Apt (Stn #03870)
- 132. February-April and June-September only
- 133. Pre-03/43 data from English Field (Stn #23047)
- 134. Post-10/66 data from Fort Wolters
- 135. Less 6/68
- 136. For hours 00-23 and 07-22 LST
- 140. Also contains annual ceiling/visibility tabulation
- 141. Less 0000 and 0300 LST
- 142. See Killeen
- 143. See Dugway PG
- 144. Data for 1943-49 for Wendover AFB (Stn #24111)
- 145. 0400-1800 LST
- 146. See Washington, DC Dulles International Apt WBAS
- 147. See Washington, DC National Apt WBAS
- 149. 0700-1200 LST
- 150. Tower data, year-month-level, month-level, and month-level-hour
- 151. Pre-11/41 data from Paine Field CAA (Stn #24222)
- 152. 10 observations per day closed on weekends
- 153. 10 observations per day wind speed estimated
- 155. By 5°F temperature intervals with and without thunderstorms
- 157. One speed group greater than 14 knots
- 158. Speed classes in Beaufort Force mean speed by direction in mph
- 159. Hourly groups for 0600-1600 LST
- 160. Post-05/55 data from Forest Sherman (Stn #03855)
- 161. By speed classes and 5°F temperature classes
- 162. For all hours combined and for hours 0030 and 1230 individually

CITY	TAPE - TYPE	SŤ		<u>د</u>	LAT	L∃#G	ELEV	9€ 051 3€ 1 ×€C390	201-max	50 111	*****
AMMISTON	CALHOUR CO APT CAR	٩Ļ	13071		33 35M	385 51W	2183	21 45 - 12 54	STAR	S.A.	713272
MANDHINES 6	MUNICIPAL ART HORS	AL	13875	72228		285 454	3193	31 50 - 12 54	STAR	79	712741
SIRMINGHAM SIRMINGHAM	MURICIPAL APT WAS MURICIPAL APT WAS	AL AL	13875	72228	33 344	286 45H	2192	01 71 - 12 71	STAR	SA SA	T:3616
FOOT SUCKES	CRIAMES AMP	46	93950	14225	31 :55	285 436	3192	01 72 - 12 72	STAG	3A	750979 712761
HUNTSVILLE	HUMTSVL-MOISON CAP WAS	46	22856	72323	24 42M	386 354	0185	01 60 - 12 64	STAR	SA	T1-715
HURTSVILLE MOBILE	HUNTSVL-MOISON CAR HOAS SATES FLD HOAS	AL AL	13894	72323	34 39N	386 46W	0196	01 72 - 12 72	STAR	SA SA	750979 712926
-datre	SATES FLD WORS	AL	13894	72223	30 41H	986 :20	0059	01 70 - 12 74	STRO	SA	752078
33100	SATES FLD WORS	AL	13694	72223	30 418	286 154	2066	01 70 - 12 70	STRE	SA	T12925
731160H 73611£	SATES FLO WOAS SATES FLO WOAS	AL AL	13894	12222	30 41R	C86 :54	0088	31 71 - 12 71	STRE	A .	701772
MONTGOMERY	OARRELLY FLO WOAS	AL	13895	·72225	25 194	086 15H	2081	01 72 - 12 72	STAR	SA A	750979 · 713967
MONTGOMERY	SANNELLY FLD WERS	AL	13895	72226	25 19M	286 244	0051	01 72 - 12 72	3.7mg	SA	T50979
SELMA	CRAIG AFS	AL.	12050		35 SJW	286 594	0053	01 54 - 12 58	STEG	SA	T13967
TUSCALOGSA	YAR DE GRAFF APT CAA	AL	93806		33 1-0	387 374	0057	01 49 - 12 54	5749	A	751862+3
ANCHORAGE	CLIMENGORF AFE	AK	26401	70272	61 15M	149 466	0054	01 51 - 12 70	STAG	-	T15332.3
ANCHORAGE	INTERPATIONAL ART LARS	AK	25451	70273	61 10N	150 012	0046	01 55 - 12 59	STAG	~	T13853
BIG DELTA	FRA FRA	AC AE	26415 26415	70267 70267	54 COM	145 440	0369	01 60 - 12 64	STAR	SA SA	714063 714063
CORDOVA	TILE 13 APT FAG	AE	26410	70296	50 308	145 30k	0013	01 50 - 12 62	DAT2	SA SA	120250
FAIRDANKS	EIELSOM AFB	ΑĘ	26407	70265	64 39M	147 046	0155	01 51 - 12 70	STAG	SA	T14703
FA (28AMKS	INTERNATIONAL APT LARS	AK	25411	70261	54 49N	147 52H	0134	01 51 - 12 70	STRE	SA	T14703
GULKAMA KENAI	INTERMEDIATE FIELD	AS	26523	70271 70256	52 09K	145 27W	0461	01 67 - 12 71 01 49 - 12 58	STAR	SA MR	T14053 T15032.3
KENNE	PURICIPAL APT FAR	45	26523	70259	60 34N	151 154	0023	01 66 - 12 70	STER	SA	713073
MIDDLETON ISL	AF3	AC	25-03	70343	50 20M	146 : 941	0013	01 59 - 12 62	STAG	5.0	750520
DOUGLAS	BISBEE-OGLS INL APT WERS	-2	93026		31 27M	100 360	1252	01 50 - 12 54	STRO	SA	150672.3
OGUGL AS	BISBEE-OGLS INL APT CAA	AZ	93026	j	31 27N	109 364	1252	01 90 - 12 54	STAR	\$A	T13365
X1 N3BMC	SKY HARBOR MAP WARS	AZ	23163	72279	33 26#	115 011	0038	01 56 - 12 64	STAG	~	T14334
PHGENIX PHGENIX	SAY HARBOR MAR WARS SAY HARBOR MAR WARS	AZ.	23163	72278 72278	33 26N	112 014	0228	21 87 - 12 71: 01 69 - 12 73	STAG STAG	ren Ser	T13751
PHOENIX	SAT HAROUR THE MORS	AZ	23163	72270	33 264	115 GIR	0228	01 73 - 12 75	STAG	SA	750564.22 752279.3
SHGENIX .	SAT HAROGR FOR HORS	٨Z	23183	72276	33 25#	112 GIM	0339	Q1 73 + 12 75	STRO~		752362 - 3
PMGENIX	SAY MARGOR THE MOAS	AZ	53163	72276	33 26#	115 010	0338	01 75 - 12 75	STAR	SA	752279.3
PHGENIX PHGESGATT	SKY HAROGO FAR WOAS FURICIPAL ART WOAS	SA	23183 23184	72278	33 28M	112 019	1530	01 79 - 12 75 01 67 - 12 71	STAG STAG	SA	752362 + 3 701772
TUCSON	MUNICIPAL APT HEAS	AZ	23150	72274	32 C8N	110 574	0779	01 55 - 12 64	STAR		714334
TUCSON	MUNICIPAL APT LIBAS	AZ.	23160	72274	32 08M	110 574	0779	21 50 - 12 63	STAQ	SA	T13111
TUCZOM	INL ROT WERS INL ROT WERS	AZ I	23160	72274 72274	32 07*	110 564	0789	01 67 - 12 71	3780		T14366
TUCSON YU M	INTERNATIONAL ART MORS	AZ	23160 23185	72280	32 408	110 56H	2052	01 67 - 12 71	STRR STRQ	MSA SA	T14316 T13366
									_		
EL DORAGO FORT SMITH	GOODHIN FIELD CAM TUNICIPAL APT WARS	AG (:3964 23992	72344	33 13M 35 20M	092 464	0062	01 50 - 12 54	STAQ STAQ	2A	T50055
FORT SMITH	HUNICIPAL ART LANS	AG	13964	72344	35 20M	094 224	0141	91 68 - 12 72	578Q	rese	751827+3 714655
LITTLE ROCK	ACAMS FIELD MAP LOAS	PR	13963	72340	34 448	382 14W	0064	01 55 - 12 64	STRE	SA	T1-644
LITTLE AGEX LITTLE AGEX	ACAMS FIELD MAR WARS	PA	13963	72340	34 448	092 144	0084	31 66 - 12 70	STRE	SA	T13028
LITTLE ROCK	AGAMS FIELD MAR WERS AGAMS FIELD MAR WERS	AB	13963	72340	34 444	092 144	008 →	31 58 ± 12 73 05 71 = 07 72	STAQ STAQ	SA SA	T51046.3 T11153
LITTLE POCK	ADAMS FIELD MAR HORS	AB	13963	72340	34 44H	092 144	2084	02 72 - 02 73	STRO	5A	T01772
2 24575	MAS		2222	7.00.00		177 1011				_	
ALAMEDA AGCATA	FAR	CA CA	23239 24283	7-506	37 47M 40 58M	122 194	0009	01 60 - 12 54	STAQ STAQ	T	714269 724360
SAMERSFIELD	TEROGHS FIELD WORS	CR	23155	72354	35 25M	119 034	0151	01 50 - 12 64	STRE	A	T52395
Darersfield	MERODES FIELD HORS	CA	23155	72364	35 25M	118 025	3151	31 84 - 12 73	STAR		T50715+3
SPRERSFIELD Sishop	MEGOGWS FIELD WORS	CA C	23155 23157	72384 72480	35 25M 37 22m	118 220	1253	01 67 - 12 71 01 60 - 12 64	\$789 \$780		T14331 T15358.47H
ST ALME	RIVERSIDE COUNTY ART FOR	CA	23156		33 37%	114 434	2120	01 40 - 12 54	STOR		714358
3L YTH€	REP THE YTHUCS BOLZEBYIE	ĊA	23156		33 371	114 434	3119	09 50 - 08 74	STRE		715211
SURBANK CHINA LAKE	HOLLYNO-SURSANK ART WARS	CA	23152 93104	72288	34 !2M 35 41M	115 224	0221 0640	01 50 - 12 54 01 54 - 12 56	STRE PRT2	ma CYM	T13257
CHINA LAKE	R45	SA	33104		35 41M	117 41H	3662	01 50 - 12 63	STAG	-	T15276
DAGGETT	SAN SERMARDING CAP FAM	CA (23151		34 52M	116 474	3566	21 55 - 12 64	STAR	SA	7132 84
DAGGETT EDWARDS	SAN SERNARDING CAP FRA	CA	23151 23114	72381	34 52M 34 55M	118 47H	0566	01 55 ~ 12 64 01 66 - 12 70	\$472 \$472		T13264 751146
FAIRF IELD	TRAVES AFS	- 52	20202	74515	אלו מנ	121 56M	2018	31 50 - 12 64		.TA	T1 4239
FRESHO	AIR TERMINAL WAS	CA	23193	72389	26 479	:19:42W	2103	31 60 - 12 64	STRE	A	752395
FRESMO LING BEACH	AIR TERMINAL WARS - MUNICIPAL ART WAS	CAL	93193 23129	72389 (36 47M 33 49M	118 424	3021	01 50 ~ 13 64	STAG		T15354.3 T15332.3
LING SEACH	MUNICIPAL APT WORS	CA.	52158	72297	33 498	116 296	3021	01 60 - 12 64	STAG		713257
LING DEACH	TUNICIPAL ART WORS	CA	23129	72297	33 49M	118 094	9017	01 55 - 12 74	STAG	/TER	T15052.3
LORG SERCM LOS ALAMITOS	TURICIPAL ART MARS	CA	23129	72297	33 49M	110 034	0006	01 69 - 12 73 01 65 - 12 59	STAG STAG		T50819+3 T13257
LOS ANGELES	INTERMATIONAL ART LOAS	CA	93106 23174	72295	33 56#	118 234	3037	01 55 - 12 64	BATZ		T50246
135 AMCELES	INTERNATIONAL ART LAAS	CR	23174	72295	33 568	118 234	0037	91 50 - 12 51	STAR	;=0	71-406G
LIS AMGELES	INTERNATIONAL ART HAAS INTERNATIONAL PAT WAS	CA	23174	72295	33 56M	118 234	0037	05 54 - 04 59	DAT2		T12257
ijis AMGELES 135 AMGELES	Zebe tee Jeneitensini	CA	23174 23174	72295	33 56M 33 56M	118 23H	3037	01 70 - 12 71	STAR		T14069 T14069
TOFFETT FIELD	ANZ ZITHMANHE	CA	23244	7-509	37 256	122 COM	3012	01 50 - 12 64	STAR	78	T14269
-6EDLES	TUNICIPAL ART CAR	CA	23179	72380	34 464	114 374	3280	31 49 - 12 54	2120		713029
76EDLES 76EDLES	TURICIPAL APT CAR TURICIPAL APT FAR	ÇA	23179 23179	72380 72380	34 46A	114 37W	3250	01 55 - 12 64 09 50 - 08 74	STAR STAR		T13790 T15211
JAKE AND	INTERNATIONAL APT LOAS	CA	52320	72493	37 4-6H	122 224	2005	01 50 - 12 64	579Q		714289
32Ne40	AFE	CA	23136		34 138	:19 040	0025	01 50 - 12 64	STAR		30818
POINT HUGU POINT HUGU	ar Me	CA	93111	77391	34 37M	119 37W	2004	03 52 - 02 72	9472 9472		715332+3 750516
SINESSIDE	75 789CH 965	52	93111 23119	723911	34 379 33 538	119 3744 117 1541	3008 3461	31 50 - 12 54 31 56 - 12 70	2:ME		750618 750819•3
SIVERSIDE		ÇA	22118	72286	ココ ラコド	117 154	3-61	01 55 - 12 70	STAR		71 43 31
DTHEMASAZ	TURICIPAL APT WOAS	CR	32525	72493	38 314	121 305	3012	21 56 - 12 70	PATZ	SA	701772

•		٠							SUPPORT T	. AGC :	5748
C17*	अ लाई – राजन्द	ST	ABAR E	 0	LAT	LING	EDEA	063100 SE	Sour ZNumda	SUFF	1001/06-48KZ
SACSAMENTO	EXECUTIVE APT WORS	ÇA	23232	22463	36 31%	121 704	1 3000	D1 58 - 12 73	5788	SA	750504.47F
SACRAMENTO	EXECUTIVE APT HOAS	, CA	52525	72403		:21 304			5T##	5.4	*5G504+47G
SAM DIEGO	LINCOERGH INC APT LORS	5A 5A	52196	77290	25 ***	117 10M			STAQ STAQ		*502*6
SAM DIESS	LINGSERGH INC ART MAS	EA.	23198	72290	32 444	117 100			STOR	SA MB	713668 701772
SAN DIEGO	MAS MORTH ISLAND	ÇA	93112		32 42H	117 124			\$700		T75000
SAM FRANCISCS SAM FRANCISCS	INTERNATIONAL ART WASS	ÇR	23234	72494	37 37N	133 32M			STAR	-	7; 4299
SAM FRANCISCO	ZAGE THE JANGSTANFITHS ZAGE THE JANGSTANFITHS	CR CR	23234	72494 72494	37 37N	122 234	2002		STAR STAR	SA SA	750878.470 750878.476
SAN FRANCISCO	INTERNATIONAL APT WORS	CA	33234	77-04	37 37M	132 33M			STAG	SA	750875.479
SAM FRANCISCO SAM RAFAEL	INTERNATIONAL APT WAS	CA	23234	72494	37 37N	133 33M			STAG	54	750879 - 470
SAM RAFAEL	MARILTON AFS *	CA CA	23211	•	38 044	122 314	3004		STAG	MA SA	114209 114150
SANTA SAGGAGA	MUNICIPAL APT FAM	CA	23190		34 26M	118 50M	3004		STAG	HA	712329
SANTA MAGIA SANTA MAGIA	MARS	CA.	22226	72394	34 56M	120 254	3071		STAQ	mpt)	T50740
UKIAH UKIAH	-BAS Funicipal Apt FAG	ÇA EA	23273	72384	34 \$4M 38 38M	120 274	3073		STAQ STAQ	 	7521:0-3 750173
VAROENGERG	CAMP CHUKE AFE	CA.	93214	72393	34 43M	120 344	0116	1	STAR	-	715352.3
VAMOENGERG	CAMP COURS AFB	CA	93214	72383	34 438	120 34	0116		STRQ	758	715029
DR361301AV DR361301AV	CAMP COOKE AFO SURF	댦	83214 93214	72393 72393	34 43M	120 344	0115		STAQ	5A	750988.47E 701772
VICTORVILLE	SEGREE AFO	SA	23131		34 354	117 23M	CSGC		STAG	79	T13284
VICTORVILLE	GEORGE AFB	CA	32131		34 354	117 23W	0980	01 90 - 12 97	STAR	SA	T10284
AKAGM	MASHINGTON COUNTY APT CAR	- 63	2-015		40 07N	103 100	1286	01 50 - 12 54	STRE		71503 a
COLORADO SPGS	PETERSON FIELD WORS	C3	82037	72-66	38 4GH	104 434	1057	3: 50 - 12 73	STMR		750236
COLORADO SPGS DERVER	PETERSON FIELD WARS STARLETON INT ART WORS	==	93037	72-66	38 498	104 -34	1857		STAG	4	751947.3
DEHVER	STARLETON INT ART WAS	C2	23062 23082	72460	39 46F 39 46F	104 53M	1615	07 50 - 12 54	STAG Stag	Ann A	750313 712311
DEMVER	STAPLETON INL APT WOAS	C3	23062	77-69	39 46H	104 531	1615	01 74 - 12 74	PATZ	SA	751959 - 3
GEAMO JUMCTION PUEBLO	MUNICIPAL APT WARS MEMBRIAL APT WARS	3	23056 93056	72476 72464	39 07N	104 31F	1474	01 80 - 12 64	STAG STAG	SA	714516 750907
PUEBLO	PERMIAN APT HOAS	65	93056	72464	38 174	104 315	1-15		STAR	SA	150907 T50098
PUEBLO	PERCHANT HORS	\$20	92056	72-6-	38 17%	104 31H	1438	01 73 - 12 74	STAR	A	T15405
PUEBLO	- MEMBERSHL ART WERE	ca	93058	72-6-4	38 17N	104 314	1439	01 74 - 12 74	STMA	•	T51947.3
SAIDGEPORT	MUNICIPAL ART MAS	CT	94702	72504	41 108	073 08M	0000	01 64 - 12 64	-GTAG		712243
69 IDGEPORT HABITTORD	MUNICIPAL ART WARS SRRIMAGO FIELD WARS	57	94703 14753	72504	41 107	073 08W	0000	0: 65 - 12 69	STAG	SA MA	714793 714204
MINOSON LOCKS	SAROLEY FIELD WORS	CT.	14740	72508	41 568	072 39H	0005	01 40 - 12 52	STRQ STRQ	58 .	T14793
MIMOSON LOCAS	SAROLET FIELD WARS	C7	14740	72508	41 56A	072 41W	2061	05 73 - 04 74	STAG	Ā	750465
MINOSOR LOCKS	SRACLEY FIELD WARS	SI	14740	72508	41 95M	072 41H	0061	01 74 - 04 75	STAR	-	751792
	SKEOLES FIELD MONS	47	14740	72508	41 56M	372 41H	0.051	05 74 - 10 74	STAG	A	T52449.52
00ver 00ver	AF 5	30	13707		39 CSM	075 28W	2011	01 63 - 12 57	STAG	4	7117-9
OGVER	AFS	0€ 30	13707 13707		39 COM	075 284	0011	01 66 - 12 70	STAR	A A	T50495+3 T52367
MILMINGTON	GTR MEL NEW CAS ART MAS	0€	13761		39 40N	075 35H	2238	01 60 - 12 54	STRE	<u>~</u>	T13167
WILMINGTON WILMINGTON	GTR WIL MEW CAS APT WARS	30	13761	ì	38 40A	375 36M	3024	01 50 - 12 54	STAQ	\$A	T15634
MILMINGTON	STR WIL NEW CAS ART WAS	36	13761		39 408	075 35H	0029	01 57 - 12 57 01 60 - 12 75	STRE	SA ma	TD1776 TS0495
washingTon	MATIGNAL NOT MORS	ac	12743	72405	38 51H	077 0241	20231	3: 50 - :2 54	STAR		T14151.47%
WASH INGTOR	MATIEMAL APT WORS	00	137-3	72-05	38 51M	077 022	3023	01 50 - 12 54	STAR	Ā	514151:47I
MAZM [HGTBR	MATIGMAL APT MOAS	OC.	13743	72-05	38 518	077 02H	0023	01 50 - 12 54	STAG	2	T14151-47L
WASH INGTON	THRIDHAL ART WARS THRIDHAL ART WARS	96	13743	72405 72405	38 51M 38 51M	377 G2W	0023	31 50 - 12 54 31 60 - 12 54	STAR STAR	•	T13371 T14151.47J
WASHINGTON	MATISMAL APT MAS	36	13743	72405	38 51M	277 02W	2022	21 60 - 12 73	STAR	H	750766-474
HASH INGTON	MATISHAL APT LGAS	30	:3743	72405	38 51#	077 02W	0023	01 50 - 12 72	STAG	-	T1 4737
lashington lashington	TRIBUL APT WARS THE INDICATE APPLICATIONS	9C	13743	72405	38 51A 38 51A	377 32W	0023	01 58 - 12 73	STRG	A FSA	751800+3 713770
HASH (MGTON	MATIONAL APT WAS	20	13743	72405	38 21W	277 324	0023	31 70 - 12 70	STAR		713770
HASH (NGTON	RETIDING ART WAS	3C	13743	72405	38 51A	077 02H	0023	35 70 - 12 70	STAR	<u></u>	T01772
HAZH INGTON HAZH INGTON	TRIUMPL ART MARS	30	13743 13743	72405 72405	38 51M 38 51M	077 02H	0023	01 71 - 12 71	STAG SATZ		713770 714175
HASH INGTON	NATIONAL ART WAS	oc i	13743	72-05	38 51M	377 024	2023		STAG	HIR	T01772
::ASH [RGTBR ::-ASH [RGTBR	TATIONAL ART WORS	30	13743 93736	72-05	38 51M	377 02W	0023		STAR	4	T5:800.3
-ASH INGTON	DULLES INC APT LEAS	20	93736 93736	72-03	38 57M	077 27W	0094	01 56 - 12 70	STAG	5A 5A	T13303 T13672
HASH INGTON	SMAN TAR INL ZBILUC	ЭÇ	33736	72-03	38 57₩	077 274	200-	31 70 - 12 71	STRE	SA	T1 4565
≒ASHINGTON ≔ASHINGTON	DULLES INC APT WARS - DULLES INC APT WARS	30	73756 73756	72403 (72403 (38 57M 38 57M	077 27W	2094	01 71 - 12 71	STRQ		T14175 T14175
SAYTONA SEACH	TUNICIPAL ART WAS	- 1				1	- 1				
FORT MEYERS	PAGE FIELD WARS	71	12834 12835	72210	29 11M 26 35*	361 53W	2015	01 67 - 12 71	STRE		T50033 T50872
LACKSONVILLE	JESON APT WORS	• !	:2869	72205	30 254	381 394	2013	01 66 - 12 56	STRE		712896
JACKSONY (LLE	ITESON ART WARS ITESON ART WARS	AL	13989	72206	30 254	CG1 39H	3012	31 70 - 12 70	STAR		T12856
-ACKSONVILLE	INCOM ANT LANS INCOM ANT LANS	E	12569	72206	30 25A 30 25A	381 39W	0013	01 72 - 12 72	STRQ PRT2		701772 750163
LACKSOM YILLE	ITESON APT WARS	= -	1989	72206	3Q 25m	081 38H	0009	01 75 - 12 75	STRE	A	752247
1981 1981	INTERNATIONAL ART UP	٠.	12639	72202	25 +8P	380 16W	3004		STAR		T13861
wibwi Simui	INTERNATIONAL APT	٠.	12839	72202	25 48 8 25 48 8	080 16H	3004		STRG STRG		T52115+3 T13861
TIMMI	INTERNATIONAL AR	_	:2638	72202	25 46R	380 164			STRE	-	701772
5(AB) 5(AB)	INTERNATIONAL '	1	12039	72202		C80 16#	2004	31 73 - 12 73	ŞTRQ	≓A	750163
ulaul Jiuul	INTERNATIONAL ,	F.L.	12639	72202	25 48M	380 164	0017	31 74 - 12 74 39 74 - 39 75	STAG STAG		T52115.3 T51924.3
m(Am(L NITANRETHI	FL	12639	72202	25 -8 m	380 16H	2017	23 25 - 39 25	STRE		T51924.3
MIL TOM SRLANDO	HAITING F	FL	93841	j	30 43M	087 01M			STAG .		714557
39LA608	70037	FL	12815 12815	1		081 18H		31 56 ~ 12 57 01 70 ~ 12 70	STAR		T01772 T01772
381 9404	HGCar	FL	:2015	ł		381 18H		31 74 - 12 74	STRR		7510-6.56
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GITT	HAME - TYDE		-8-11					PER100 3		
39L 8900		5	T, •		LAT	: 3**	6 ELEV		ې چېنې د پېښې د	Y \$6## FREQ TAB#/9E!#98KS
39L AHOD	ZROW TON MOONESH ZROW TON MOONESH			77205	29 33	M 281 2	C14 3037	0: 50 - 12		
OPL AMOD	EROM THA HOUNESH	F (72205		N 281 2	CH 3037		54 STAQ 54 STAQ	711749 76 750590
39L 440g	HERMOON MOT HOMS	ř.		72205 72205				01 50 - 12	54 STAR	71 4655
PANAMA CITY	HERMOON ART WORS	FL		72205	28 33				PATE IN	5A 101772
PERSACOLA	FOREST SHERMAN NAS	FL FL		74775	1		3007 JOD7	01 66 - 12	DATE	78 750241 \$A 714171
PENSACOLA TALLAMASSEE	FOREST SHERMAN MAS	-		72222 72222			,		1 STRQ	714 987
TALL AMASSEE	FUNICIPAL ART HEAS			72214	30 238			1	4 STAG	4 752115.3
TALL AMASSEE	" MUNICIPAL ART HOAS	FL FL		72214		084 22	tu coa:	01 50 - 12 7		79 790590 SA 750413
TRUL AMASSEE TRAPA	TUNICIPAL APT MAS		13805	72214 72214				91 72 - 12 7	2 S780	750014
TAPPO	Wegitt was	Ų.	12810	74788	27 51H			01 77 - 12 7		75053d
TAMPA	INTERNATIONAL ART WAS	FL FL	12810	74700	27 51N	082 30		01 70 - 12 6		SA 712957 SA 712957
TAMPA TAMPA	CRECHATIONAL APT WORS	ř.	12842	72211 72211	27 56H			01 50 - 12 5		SA T12057 MA 750500
TACER	INTERNATIONAL ART WORS	PL.	12842	72211	27 58N			01 55 ~ 12 6	-	SA T12826
THEMP	INTERNATIONAL APT WORS	7 (12842	.77211	27 58M	282 32		01 69 - 12 7 01 71 - 12 7		9 715377 \$A 714115
TAMPA TAMPA	SAGE TON JANETTANSTRI	r.	12842	72211	27 50M			01 72 - 12 7	STAG	\$A T14113 \$A T14346
TRANS	INTERNATIONAL APT MOAS	Fi	12842	72211	27 58N	065 25		Q1 72 - 12 7		SA 7:3367
TRADA	INTERNATIONAL APT WEAS	7.	12042	72211	27 5am	382 32		01 77 - 17 7		** 15060e
TRAPA	PART TON JAMESTARESTAL	FL FL	12842	72211	27 58N	082 320		21 73 - 12 7		A 750487.3 SA 750413
· TAMPA ···EST PELM BEACH	INTERNATIONAL AOT LOAS	ΡÜ	12642	72211	27 56N 27 58A	062 321		31 74 - 12 74	· , - · · · -	A 751046
	M INTERNATIONAL ART LOAS	FL	128	72203	28 41M	280 064		01 74 - 12 74		A TSIZE+ SA TDI772
ALSANY D. AARY	TURNER AFE	GA	13615	ľ	31 35#	08e e-			-	1917/2
ALBARY ALBARY	NAS . NAS	G#	13815	1	21 254	084 054 084 054		01 63 - 12 66		5A T14372
AL BANY	. NAS	GA GA	13615		31 35M	064 054	2055	31 50 - 12 50		\$A T15175.3
AL BARY AL BARY	MAS	GR	13015	- 1	31 35H 31 35H	084 CSL	00as	01 68 - 04 74	STRE	™ 750590.3 ™ 750580.3
AL BARRY	nes nes	GA	12615	- 1	31 35A	084 05L		01 70 + 12 70 01 70 + 12 70		750690±3
AL BANY	795 785	GR	12815 12815	J	31 35A	384 OSA	2065	01 70 - 12 70 01 71 - 12 71	STAR	SA T13252 PR T50580.3
AL BART	MAS	GA	13615		31 35A 31 35A	084 CSL		01 72 - 12 72	STAG	750590.5
AL SART AL TA	ARCON COMMENTS	GA	13815	- I	31 25M	081 12M		01 73 - 12 73 01 74 - 04 74	STAR	750890.3
ATHERS	SER EPPS FIELD HORS	GA	13670		31 32M	082 31W		01 74 - 04 74 01 54 - 12 58	STAR	750890,3 5A T15175.3
ATHERS	SER EPPS FIELD WARS	GA (72311	33 57M 33 57M	083 185		01 69 - 12 73	STAR	\$A T15175.3 \$A T15175.3
ATLANTA ATLANTA	140AS	GA		77210	22 398	082 196 084 256	0302	01 70 - 12 70	STOR	SA TIBES
ATL ANTR	HOAS	GA		77219	33 39m	084 26M	0311	01 59 ~ 12 63	STAQ STAQ	\$A T12598 \$A T01772
ATL ANYA	HORS	GA GA		72219	33 39M 32 2E	Q84 25W	0315	31 69 - 12 73	STAR	\$A T01772 \$A T15175.3
ATLANTA ATLANTA	HORS HORS	GA			22 38×	084 25H	0311	01 70 - 12 70 01 70 - 12 70	STAG	SA 701772
ATLANTA	LEAS	GA		72219	33 39M	084 26H		01 70 - 12 70 01 72 - 12 72	STAG	SA 113494 MB 114300
AUGUSTA	SUSH FIELD HORS	GA.			33 39M	784 264		27 73 - 35 74	STRO	M9 71430g A 751135
AUGUSTA AUGUSTA	BUSH FIELD WARS	GA	33650	72218	33 22M	081 58W		01 55 - 12 55 01 57 - 12 71	STAR	SA T01371
PUGUSTN	BUSH FIELD HOMS	GA			33 22M	001 56M		01 67 - 12 71 31 68 - 12 73	STAG STAG	SA T14010 SA T15175.3
#UGUST#	SUSH FIELD LAMS	. GA			73 22M 72 22M	201 50H		91 70 - 12 70	STAR	\$A T13252
AUGUSTA AUGUSTA	SUSH FIELD HORS SUSH FIELD HORS	GA			33 226	281 56W		01 72 - 12 72 01 75 - 12 75	STAG	T14399
9BAN2P1CX	SUSH FIELD WEAS GLYNCH HAS				33 2ZW	381 56W		01 76 - 03 76	STAG STAG	715602 715673.52
ednuzhicz	SLYMCD NAS	1	93836 93836			081 28W	1	21 57 - 12 71	STRO	SA T14372
CBLUMBUS BRUNSMICX	GLYMCS MAS	GA	92826	1		001 255/ 361 255/		31 50 - 12 73 31 79 - 12 70	9KT2	SA 715175.3
COLUMBUS	ACTROPOLITAN APT WAS		23842		32 31M	284 SEL		71 79 - 12 70 71 67 - 12 71	STAR	SA 713252 SA 714065
COLUMBUS	HETROPOLITAM APT HEAS	2.1	93642 93642			204 564	0118	71 69 - 12 75	STAR	SA 715175.1
MACON	LEMIS S MILSON ART HORS	G#				084 28H		11 70 - 12 70 11 57 - 12 71	STAR	* T14041
~~C3m	LEWIS 8 WILSON APT WORS				32 42M	262 28H		11 67 - 12 71 11 68 - 12 73		\$A
SAVERNAL	TRAVIS FLD MAP WOAS					083 38H		11 70 - 12 70		SA T13252
SAVARRAH SAVARRAH	TRAVES FLD MAD WORS	GA (03822 7	2207 3		081 126 081 126		11 56 - 12 70 11 57 - 12 71		5A T13050
SAVARREN	TERVIS FLO MED LORS			2207 3	2 08# (D61 12H	0016 0	1 60 - 12 73		SA T14065 SA T15175.3
SAVARRAM	TRAVES FLO MAP WORS					261 124	1 -	1 70 - 12 70	STRE	SA 101772
2WACHURN 2WACHURN	TRAVIS FLD THE MERS	GA :	23622 7	2207 3	2 38# 3	351 12W(351 12W(0015 2	1 70 - 12 70		SA T01772
25 AUMUNH	TRAVIS FLO THE HOAS		03622 7: 03622 7:	7207 3	2 08N	781 :2H	0016 0	7 73 - 36 74	STAG :	7:4398 SA 750649
SAVERRAM	HUNTER AFE	- , -	13824		3 GEW 3	181 13H	0018 0	1 75 - 12 75	STAQ :	752184
THIDS 2938PA	nes	ـ این		1		- 1	- 1	- 90 - 12 70	STRE 5	5A 715175.3
THIS 2838RE	465		2514 9: 2514 9:			58 044	0015 0			T 750709
MILD MORGLULU	THAN FIELD WAS	41 3	11504 91				0015 0			₩ 150121
KAMULUI	JOHR ROGERS INL APT HORS		2521 9:	1182 2	1 21N 1	37 56W	CD13 C:			9 T13223 9 T5G121
PUUMERE	TAM	. 1 -	!2516 9; !2525	1190 2	0 544 1 0 504 1	56 26M	3015 3	1 56 - 12 70	STRQ 5	A 713335
35106	Muhrcian sac	-		"	9 3UM)	20 ZDW	2040 0	1 53 - 12 57		A 7:3204
IDAMG FALLS	MUNICIPAL ART WAS FAMBLED FRA						0870 01	1 60 - 12 54	STAR -	T 750544
makad CITY	CAA		4145 4151			12 04H	1446 01	1 55 - 12 64		9 751224.5
MOUNTAIN ⊣OME POCATELL3	af 5	:0 2	4105	43	3 33M t		:266 0; 09:2 0;		STAR	A 751224.3
POCATELLS	TURICIPAL APT MASS	:0 3	4156 72	578 42	2 55A I	12 35Wi			STRR == STRR ==	
POCATELL 3	FUNICIPAL APT HOAS	:D 2	4156 72 4156 72	578 42 678	2 55N 1	12 36H	1355 31	58 - 12 62	TAR 5	
SELLEYTLLE	SCREE ACE				2 55M ;	15 39F	:265 31	65 - 12 74	TAR H	
EDROI HE	SCOTT 4F8 RIDHAY 40T LBAS		3802			89 9 H (225 22	51 - :2 70 :	TAG SA	
CHICAGE	TIDERY APT LORS		4019 72 4019 72		478 31	97 45W()	J167 J1	54 - 12 73 1	THR 5	
CH ICAGO	SABLE TORY PERS	. 1		534 41		97 45W (97 45W (LZ RATE	9 750404
		1				1	"		TRR SA	711930
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		\$1	<u>'1 * </u>		1 6	• •	DHE	1 Er E.	08C3S 1	3442	F3E2	T#61/985
CHICAGO	TOWAY APT WAS	:1	14819	7253	41	47N	387 45	ul 318	7 01 99 - :2 58	STAG	•	7;4943
CHICAGO CHICAGO	FROM PAPE HOS	17				47N	287 45		7 01 70 - 12 70		SA	701772
CHICAGO	MIDWAY ART MORS	:1L				47N*					A	TS 1304
CHICAGO	TIDUAT APT LOAS	11				478	087 45				SA A	701772 714943
CHICAGO	TIDLAY ART WARS	:1				47N	387 -				SA	T50404.
CHICAGO CHICAGO	MICHAY ART LIGHS MICHAY ART LIGHS	i L				47N	367 45		1 12 72 - 11 73	STAG	54	T50446
CHICAGE.	MIDWAY ART LEAS	ir ir	14819			47N	767 -50			STAR	A	750549.3
CHICAGE	MIDHAY SOT HOAS	î.	14019			47N 47N	387 ~ 51			STRE	SA	751207+3
CHICAGO	MIDURY APT LIGHS	n.	1-619			47H	387 451			STRE	7	752944.3
CHICAGO CHICAGO	ZAGH TRA JM1 3BAH' D ZAGH TRA JM1 3BAH' D	1.T	3-0-6			50M	387 544	-,	01 53 - 12 55	STAR	Ä	T11860
CHICAGE	3'HARE INL APT WARS 3'HARE INL APT WARS	n.	34646			SOM SOM	007 544		1	STAR	•	T11860
CH ICAGB	G'HARE ITE APT MARS	11	34646	77530 77530		50A	287 544 287 544			STRO	SA.	T1276J
CH I CAGO	G HAGE INL APT LORS	IL.	94846	72530		50A	087 544			STRE	2	T11560 T11560
CHICAGO CHICAGO	SAGE THE ART HAS	ĮL	3-0-0	72530		59M	087 544	4 3211	31 69 - 12 64	STAQ	SA	751955.3
CHICAGO	ZABL TOA JEL 3DAN'D ZABL TOA JEL 3DAN'D	IL IL	9-0-6	12530		56M	387 5-4		1	578Q	•	T1:860
CHICAGO	TETES FIELD LALE	n.	94046	72530	41		087 544			STEQ	=	T13303
Gr EHA LEM	765	n,	14855		43		007 50L			STAG	75 75	T14901 T50250
GLERVIEH	MAS	:L	1-655		42 (987 5QL			STAR	4	791686+3
mar ing Maring	GUMO-CITY MAT WAMS GUMO-CITY MAT WAMS	n.	14923	77544			790 316			9ATZ	SA	T13553
PEBRIA	SHOW THE MINUS PART HORS	IL IL	14042	72544 72532		27N 40N	390 311		01 70 - 12 74	STAG	50	751153-3
PEGRIA	CACH TON AIRCOS ROTAGED	ÎL	14042	72532		40/7	089 411	,		\$789 \$788	SA SA	T1-042 T12089
PE291A	GREATER PEORIA APT WAS	İL	14642	72532		-017	089 41L			STRO	SA	750660-3
PEDRIA PEDRIA	GREATER PEGRIA APT HOAS	IL.	14842	72532	1 -	401	088 416		01 65 - 12 40	STRE	SA	751309-3
PEORIA	CREATER PEDRIA APT WOAS CACATER PEDRIA APT WOAS	îi.	14642	72532 72532	_	40M 40M	300 415	-,	01 70 - 12 70	STAG		712707
PEBRIA .	GREATER PEDGIA ANT HOAS		14842	77532	1 -	-C#	089 415		01 72 - 12 72 01 73 - 12 73	STAG		T50443
SCOULD .	GREATER PERRIA APT MASS	11	14642	77532	1 -	4QH	388 -1H		01 73 - 12 73	STRE		T1-042 T50443
SUINCY SARTOUL	SALDWIN FIELD CAM	:4	32969			56/1	091 126	0233	91 50 - 12 54	STAR		7137 0 9
RANTOUL	CHARUTE AFB	IL IL	14605	77531 72531		104	000 000		01 58 - 12 62	STAG		T1 4464
20CXF090	GREATER ROCKFORD HOT WORS	rı.	34422	725-43	40 1	198 128	089 084	,	01 63 - 12 57 01 66 - 12 70	STAR		101772
90C4F0RD	GREATER ROCKFORD AFT WORS	rı.	34622	729-13		12M	089 064		01 56 - 12 70	STAG		713357 71 4023
90CXF340	CHEATER ROCKFORD AAT WORS	T.	94622	72543		126	C89 C5M		01 70 - 12 74	STRO		751153.3
spoingfield spoingfield	CAPITAL APT WORS CAPITAL APT WORS	IL	83832	72439		50R	C89 40M		01 57 - 12 71	STAG		T13344
SP9 INGF IELD	CAPITAL APT MORS	IL.	93822 93822	72438			389 40M		Q1 67 - 12 71	STAG		T13563
			8-10-4-4	72-39	38 5	50M	0819 4014	0187	01 70 - 12 74	STAR	\$A	121123-2
EANUZALITE	SACSS PERMITAL ANT WARS	134	93617	72432	38 0)3M	067 32W	0122	01 50 - 12 64	STAG	SA :	711898
CANNATE	ORESS REMODERL APT WERS	134	93017	72+22	28 0	127	067 32W		01 54 - 12 64	STAR		150423
EANUSALITE EANUSALITE	DRESS MEMBRIAL ANT WAS	770	93017	72437	38 0		087 326		01 56 + 12 70	5780	SA	T12861
EVANSVILLE	DRESS MEMBRIAL ART LEAS DRESS MEMBRIAL ART LEAS	IR IR	93817 93817	72432 72432	38 0		007 374		31 66 - 12 70	STAG		750020
FORT WAYNE	SACA FIELD	. In	14627	72533	41 0		367 326 365 126		01 72 - 12 72	57 00 57 00		T15207
FORT LATTE	SACE FIELD	111	14627	77533	41 0		385 13M		01 70 - 12 74	STRE		752126.3 715675.3
FORT WATHE FORT WATHE	SACA FIELD SACA FIELD	120	1-627	77933	41 0		365 12W		01 70 - 12 7-	STAR		115675.3
ING I RRAPOL IS	HEIR COOK MAN HONE	HI.	1-027 93819	72533 72438	41 0		385 129		01 75 - 12 75	STAG		792409.3
ING FARABOL :5	ZAGE SHE FRE STORE	in	32418	72-36			C86 354 D96 154		01 55 - 12 74 01 66 - 12 71	STAG		75 1827
SOUTH SENO	ST JOSEPH COUNTY APT LIGHS	IN	1-0-0	72535	41 4		086 19H	3238	01 67 - 12 71	STAG		750262 713709
2001₩ 5ER0 2001₩ 5ER0	ST JOSEPH COUNTY ART WARS	IM	1-0-0	77535	41 4		099 18P		01 70 - 12 70	STRE		113534
TERREute	HULMAN FIELD CAM	IN IN	14645	72535 . 72 -37 !	19 2		386 ISM 387 ISM		01 71 - 12 71	STRQ		113534
		•				,,,,	20 , tGm	3181	01 50 - 12 5-	STAR	• 1	13708
909L17GTJM 23C17GTJM	TUNICIPAL APT WARS	:8	1 493 1		40 4		091 074	3212	01 67 - 12 71	STAR	A 1	12709
262 -01462	MUNICIPAL ART WARS MUNICIPAL ART FAG	IA	14933	725-4	41 3		393 Jew	0290	01 72 - 12 72	STAG		15195
SIGUX CITY	TURICIPAL APT WARS	IA I	; 4940] 4943	72557	43 11		996 27W		01 70 - 12 74	STAR		51799
HATERL 30	TUNICIPAL ARY SALA	IA.	9-915	725-0			C85 3-41	3270	01 70 - 12 74	STMG STAG		51799 50709+3
FT LEGVENHORTH	SHERMAN FIELD AAF	₹\$	13021	- 1							·	
SARDEN CITY	TUNICIPAL APT CAR	22	23084		39 2	_	094 55W	3239	01 62 - 12 70			50127
2390F W40	REMMER FIELD WOAS	45	23055	72-455	37 50		100 434 101 424	1112	01 50 - 12 54	STAG STAG		5097 4.3 15038
3300L 489	REMMER FIELD WORS	45	23065	72-65	39 2	2=	:03 424	1112	01 59 - 12 77			15169
TOPERA	SILLAGO TAR HARS	42	:3996	72-56			095 78W	3260				1-659
MICHITM	TUMICIPAL ART MONS	3.5		72 ~56 			295 28W(297 25W(91 72 - 12 72	•		01777
HICHITH	TOPICIPAL BOT -ORS	43	22858	72-50	37 39	en :	397 254	7403 7408	01 63 - 12 72 01 70 - 12 74			30300 31200.3
MICHITA	TURICIPAL ART -OAS	43		72-50	37 31	9# 3	97 25H	2408	01 73 - 12 73			30200
SOM ING CREEN	SITY-COUNTY ART GAA	57	23606	1				١ ١				
23P8 IN	SAR	57	33814	l	35 56 36 56		264 COM		01 50 - 12 54			11696
COVINGTON	STR CINCIPRATI PRY MARS	47	73814		39 04	44 ;	184 40U	3270	10 49 - 09 5-		-	11596 11696
C34/4GT9# C34/4GT9#	STO SINCIPARTI ART WORK		32614				184 40W	0270			-	50C64
COVINGTON	STR SINGIRMATI APT WORS		33814		39 33		84 40H				SA T	15172
234140;244	STO SINCINANTI ART LANS		93614 93614	72421	39 34		184 40H					15675.3
COVINGTOR	STE CIRCIPRATI ART LAAS	17	93814	72421	39 00		100H		01 70 - 12 74			15675 • 3 15207
C3Y:7GTG# C3Y:7GTG#	STE CIRCINHATI ART WAS	KT!	93614	77471	39 33	3m 3	140+ PB(3265	01 73 - 12 73	STAR :		511 44 .3
2341MG 13M	STR CINCIMMATI ART WAS		93614	72421	39 33	3a (led 40ui	0265	04 74 - 07 741	STAG :	• T	50322
FORT CAMPAGELS	CAPPACLL AFE	CT	13806 33814	72421 74671		5 DH 1	187 TOU	0371	01 75 - 12 75 01 58 - 12 52	STAG :		52-09+3 1:896
COOT LEGY	SSOFMA AAF	47	13807			444	25 56wi	2238	01 54 - 12 58	5174 S	_	1 1996 1 1996
LEXINGTON LOUISVILLE	STORE CRASS FIELD HEAS	47	93620	77+72	36 32	2N 3	14 C6 PB	0299	01 50 - 12 54	STAG	-	1:396
13012ALFTE	SAMOIFERD FICLD WAS		72521	72-23	36 ::	:n :	25 444(3149	01 50 - 12 54	STAG :	A T	11898
COURSYILLE	STAMOIFING FIELD -OMS		93621	72-23	38 11 38 11	10 C	25 444 25 444	3149	01 64 - 12 54			. 2099
1301241772	ZROW CUSTY CHETTOMATE				38 ::	in 3	85 44H	3149	01 56 - 12 70 01 67 - 12 71		5A 71 75A 71	:2951 !+316
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CITY	HARE - TYPE	5	Tı a		1 147	7,340	EFEA!		201] TR01/0[=0045
19012A1FFE 19012A1FFE	STANDIFORD FIELD WARS STANDIFORD FIELD WARS	•				M 085 44		31 79 + 12 70	1 ST#9	50	712274
FORTSAIFFE	STANDIFORD FIELD -ORS	٠ •						01 79 - 12 77	I STAR	A	F15172 -
PROUCAM	BRAKLEY ART GAM	4	,		2 38 11 		-, -, -,	91 79 - 12 75 91 50 - 12 54		SA	750329
PAQUEAM PAQUEAM	SARKLEY AAT FSS	4	1		37 34			01 55 - 12 54	J	5A 1774	711898 T13094
	SARKLEY ART FES	⋖.	7 3301	6	37 54	M 386 46	□ 3131	31 50 - 12 54		799	T1 4528
ALEXMOSTA ALEXMOSTA	ESLER FIELD	U			31 23	P 092 :81	ul 0035	01 70 12 75	5744	50	~50566
SATON ROUGE	ESLER FIELD FAR WARS	£.1			31 23			01 70 - 12 74		SA	791256.3
SATOR ROUGE	RYAM FIELD THE WORS	L d			30 33			01 55 - 12 54	17A@	798	714291
BATON ROUGE BATON ROUGE	TYPN FIELD THE HOAS	L.		-	30 22			31 56 - 12 70 31 70 - 12 74	,	A SA	713050 751258-3
SATOR ROUGE	RYAN FIELD MAR HORS RYAN FIELD MAR HORS	1.2			30 321			31 70 - 12 70	STAR	4	113050
SATON ROUGE	EVAN FIELD THE HORS	i A			30 321			01 72 ~ 12 72 01 72 ~ 12 72	STAG	7	T14338
LAFAYETTE LAKE CHARLES	MUNICIPAL ART CRA MUNICIPAL ART WAS	L			30 12	4. 381 28r		01 54 - 12 58	STAG	A 5A	751096.3 750753
LAKE CHARLES	MINICIPAL APT HORS	L.F		,				01 66 - 12 70	DAT2	A	750886
LAKE CHARLES	MUNICIPAL ART WEAS	Ü,						01 56 - 12 70 01 70 - 12 70	STAR	1	713050
LAKE CHARLES	MUNICIPAL ART WORS	Ų.A			30 07	1 293 134	2005	01 70 - 12 74	STAG	A SA	T13080 T51286,3
LAKE CHARLES	CHENNAULT AFS	LA LA					,	01 56 - 12 62	STAR	HA	750749
HGM48€	SELMAN FIELD CAN	LA			421 DC 1 416 GC			01 58 - 12 62 01 54 - 12 56	STAR	SA	751092.3
MINAGE MINAGE	SELMAN FIELD CAN MDISANT INC APT HOAS	ĹA			25 219	120 260	0028	01 54 - 12 56	STAG	SA ·	· 751265.3 750555
MEM ORLEAMS	TRISANT INC APT HOAS	LA						01 50 - 12 54	STAG	~	713267
HEH GRLEAMS	PRISANT INL ART LOAS	LA					,	01 66 - 12 70	STAG	2	T1:3060
MEM GRLEAMS MEM GRLEAMS	MGISANT INC APT WARS MGISANT INC APT WARS	Ĺ.A	12916	72231	29 508	390 ISH	1	01 59 - 12 73	STAR	SA	713574 750827
HEH GALEANS	MUISANT INL ART WASS	L A L A	12916		29 50m			01 68 - 12 73	STAQ	778	T50208
EMAZJRU WZM	PROM THE JAL TRAZIES	LA	12016					21 70 - 12 70 01 74 - 12 74	STAQ	A	T13060
MCM GRLEAMS MCM GRLEAMS	MISART IN ART WARS	LA	12915	72231	29 59H	390 154	0006	01 75 - 12 75	STAG	770 1900	T52214.3 T52214.3
MEM GRLEAMS	each tea jai tracion each tea jai tracion	LA LA			29 56M		0006	10 75 - 12 75	STAR	-	T\$2221
MEH GREEAMS	CALLENGER MAS	LA	12990		29 50H		,	91 76 - 95 76/ 91 67 - 12 71	STAR STAR		752221
NEH GRLEAMS SHÆEVEPORT	CALLENGER HAS TURICIPAL APT LOAS	LA	12996		29 5CM			01 70 - 12 74	STRE	SA AZ	751018 751904-3
SHREVEPORT	TURICIPAL APT LAMS	LA LA	13957	72246 72246	32 28R	093 49H		21 60 - 12 64	STER	•	713121
ZHEEAE DOOL	MUMICIPAL ART WERS	- CA	13957	722-0	32 28M	093 49M	1 1	01 67 - 12 71 31 70 - 12 74	9872 5780	SA SA	T1=024
SHREVEPORT SHREVEPORT	MURICIPAL ART LARS MURICIPAL ART LARS	LA	13957	72240	32 28H	093 46H	0061	01 71 - 12 75	STRE	5A	T31266-J T32296-47H
SHREVEPORT	CUNICIPAL APT MAS	LA LA	13957	72240 72240	32 26M	083 46P 783 46P		91 71 - 12 75	STAR	SA	752296,47H
SMEEVERGET	FUNICIPAL APT LAMS	LA	12957	72240	32 26M	083 +8F		01 73 + 12 72 01 75 + 12 75	STAG STAG	SA CT	714339
AUGUSTA	STATE APT CAR		1				1 1		2	_	752 44 5
AUGUSTR	STATE APT CAR	rec rec	14605		44 198	059 46U 059 46U		01 50 - 12 54	STAR	SA	750831.70
AUGUSTA	STATE APT CAM	me.	1-605		44 198	059 484		01 50 - 12 54 1 71 50 - 12 54 1	STAG STAG	msa Sa	T50394 T50452
AUGUSTA SPURSMICE	STRTE APT CAA Mas	HE	1 7605	_	44 198	369 46H	0:00	1 50 - 12 54	STAG	3A	750831 - 68
CARISOU	MUNICIPAL ART MARS	PE I	1-611	74392 72712	43 53N	369 564		01 50 - 12 69	STAR	SA	T13766
OLD TOWN	FAR	170	14622		44 57N	058 01H		71 53 - 12 52 71 50 - 12 54	\$799 \$799	SA	713766 730949
OMA JTRDS	INTERNATIONAL ADT LAAS INTERNATIONAL ADT LAAS	ME	14754	72606	43 396	370 19W	0024	11 55 - 12 54	STAR		713766
ONA JTRDS	SABE TOA JOHEST AND THE	7	14764	72608 72608	48C EP	970 1944 970 1944		11 50 - 12 5+1 10 73 - 09 741	SAT2		T13941
AGERDEER	PHILLIPS FIELD MAF	_						/1 - 04 /-	STAQ	. 	T51269.3
ANGREES AFE	HASH INGTON OC	70	13701	72403	38 20m	076 :QW		1 55 - 12 57	STRE		T13616
SML TIMBRE	FREE THE SHI RINEOMSIFF	770	93721	72406	39 117	076 40M		11 56 - 12 70	STRE STRE		750028 *14479.47J
SALTIMBRE SALTIMBRE	FRIENDSHIP IN. APT WAS FRIENDSHIP IN. APT WAS	~0!	73721	77-05	39 11M	376 401	0060 0	1 50 - 12 54	STAR		T1 =535 • = 7H
SALTIMBRE	FRIENDSHIP INL APT MORS	70	93721 93721	72408 72406	39 11M	375 40W		11 60 - 12 54	STRE	\$4	T14479,47I
SALTITURE	FRIEROSHIP INL ART WORS	~⊙ i	93771	72-406	39 11M	375 40H		11 60 - 12 64	STAR		71 -479, 476 71 -479, 476
SALTIMOSE SALTIMOSE	FRIENOSHIP INC APT WAS FRIENOSHIP INC APT WAS	70	23721 23721	72406 72406	39 11A	075 40H	0060 0	11 54 - 12 54	STAR	5A .	T11978
SPLTIMBE	FRIENDSHIP INL APT MAS	~	93721	72-08	39 11h 39 11h	075 40H		1 68 - 12 58	STAR STAR		711978 750651
SALTIMBE	FRIENOSHIP IML APT LARS	-0	93721	72405	39 11M	075 40H	2060 0	1 68 - 12 58	STRE STRE		750651 713770
SALTIMORE	FRIENDSHIP INC APT WOAS FRIENDSHIP INC APT WOAS	-70 I	93721 93721	72406 (39 IIN	075 40H	0050 0	1 70 - 12 70	STAR	-54	713770
SALTIFICE	FRIENDSHIP INL APT WERS	-0	93721	72-05	39 11A	375 40H		1 71 - 12 71	STRE		111770
SALTIMBRE SALTIMBRE	FRIENDSHIP INC ACT LIGHS	72	23721	72-05		376 404	0080 3	1 73 - 12 73	STAQ		71-175 750262
SALTIMORE	FRIENDSHIP INC BOT WAS FRIENDSHIP INC BOT WAS	70	93721 93721	72405	39 11M	376 404			S7AQ	-3A :	15290
SALTIMORE	FRIENDSHIP INL APT LARS	⊢ 0	13721	72-05	38 11W	375 40H			STAQ STAQ		751155 752259•3
CARP OSTRICH	AF Tipton aaf	3	13749]	39 26M	377 274	0:01 0:	1 49 - 12 52			752759.3 750767.3
FORT MERCE	TIPTOR ORF	70	93733 93733	ļ	39 35M 39 35M	076 45H			STRE	SA 7	14479.471
FOOT HEADE	TIPTON PAF	70	23733	[39 35A	076 458					752371 '14479,47L
FORT MERGE FORT MERGE	TIPTON AME TIPTON AME	79	93733		39 354	078 45H	3043 0	1 60 - 12 64	STRE	SA T	1 4479 , 47K
HAGERS TOWN	TUNICIPAL ART SAME	10	93733 93788	[38 42M	375 46W					14479,473
EBAIN THEXTLES	785	70	13721	72404	38 16m	076 254	3014 01	1 53 - 12 72			15290 • 26 1 4630
PATUAZHT RIVER	785 385	79	13771	72-04	20 18M	376 25M	001-4 01	1 57 - 12 71	2100		50220
PATUMENT SIVES	HAS	70	13771	72404	38 18M	076 25W					13770 13 45 6
ROVIS THOSEUTES	7AS	70	12721	72404	38 188	375 254	0014 01				13770
SAC :SBURY	HAS HICOMICO COUNTY APT CAA	70	13721	72404	35 15N	078 254	0014 01	1 72 - 12 72 :	STAB	TSA T	14175
SAL ISBURY	SICOMICS COUNTY SET CAS	70	93720		28 20M	375 30H					1.4630 1.5290
3EDF390	L G HARSCOM FIELD AFE	-				- 1	- 1	}			
505.TON	LIGHMING ART WAS	3		72500	42 48N	371 174 371 324					01772
30270M	LEGAN INL ART HORS	:===	:4739		42 22N						13333 01772
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CITY	HAME - THEE	**		- 0	_		252130 3F	SUPPARY	Sur
				<u> </u>	_ · 13M	G ELEVI	RECORD	SBAL	F9E3 T98+/9E74445
SOSTON CHICOPEE FALL:	LOGAM INL APT BRS	-	14739 72	509 42 2	29 371 C			!	
CHICAPEE FALL		,-4	14703 74		24 371 S		01 72 - 12 72	STAR	54 750656
FALTOUTH	S LESTOVER AFE STIS AFE				2m 072 3		01 60 - 12 64	STAG	SA 7:3722
PITTSFIELD	TUNICIPAL ART CRA	-	14704			141 3042	01 50 - 12 59 01 50 - 12 54	STAQ	SA *50572
SOUTH GETTOUTS	TOTAL MAT GRA	7	14763			BH 0358		STAG	\$A 150421
₩09CESTER	PUNICIPAL ANT HOAS	- TOP	14790			644 2051	31 40 - 12 58 31 70 - 12 74	STAG	58 71-019
-OGCESTER	TUNICIPAL APT LOAS		94746		5M 371 5		31 55 - 12 50	STAG	\$8 752024.3 \$ 711927
09CE57EA	FUNICIPAL ART WAS	55 65	34746 34746		84 071 52	5m 0310	31 72 - 12 72	STAR	\$ 711927 \$A 750565
			377-00	47 1	50 371 5	2H 3310	05 74 - 34 75	STAR	SA 151792
	3055 FIELD	ri f	94671	42 0	GN 386 26				
TIBETIC TIBETIC	CITY APT MAS	AL.	14022				21 74 - 12 74	STAG	SA 751045.47N
TIBETEC	CITY APT MOAS	At 1	14022	1	50 CBC 05		31 69 - 12 73	STRG	A 715015
TIBETSC	CITY APT WEAS	#£	1-627	42-25			01 73 - 12 72	STEG	3A 750049
TIDETAC	CITY ART LOAS CITY ART LOAS	MI.	14622	42 25			01 73 - 12 73	STAG	\$8 750206
TIOSTSO	TETRO-LATHE CAP LIBES	AL.	14622	42 25			01 75 - 12 75	STAG STAG	SA 751021
TIOPTEC	METHO-MATTE CAD MERS	41	9464 7 725				01 71 - 12 71	STAG	SA T52105
TIDETIC	FETRO-LINVINE CAP LIGHT	7.1	1-6-7 725		M 983 20		91 72 - 12 72	STAG	SA 150044
T10FT36	PETRO-MAYNE CAD MAS	LL I	94647 725				01 73 - 12 73	STAR	
TIBET3C	TETRO-MAYNE CAR MAS	71	94647 775		444 50	H 0202	01 74 - 12 74	STRE	5A 750206 7A 752442
TIBRESC	PETER-MAYNE CAR MARS	1	94847 725				01 74 - 12 74	STAR	SA 751021
LF INT	SISHOP AGT LOSS	7.5	24847 725: 14626 726:				31 75 - 12 75	STRG	SA 752135
FLINT	SAGM FOR MEMZIS	me	14626 726	- ,		-1 4-2-1	01 60 - 12 64	STRO	PR 750440
FLINT	SAGH TOA SONELE	ĦΣ	14926 776				01 65 - 12 50	STAQ	SA 711972
FLINT	ZROH TRA ROHZI C	75	14026 776			1	01 56 - 12 75	STAQ	PR T52408
FLINT FLINT	SMOH TOR OBHELD	71	14026 776				01 72 - 12 72	STRE	\$A T01772
FLINT	SAGN TOR HORS	ME	14926 7263			, ,	31 73 - 12 75		SA 750512
FLINT	SABU TOS SENS	mr	14626 7783	7 42 50			74 - 12 74		5A T91021
GM I Free	SIZHOP APT WARS	71	14625 7263			1 1	01 75 - 12 75 03 75 - 02 76		SA 152135
GLIMA	I SHLYER AFE	mf i	24636	45 21		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			752+0a
LARSING	CAPITAL CITY APT HEAS	mr i	94036	45 21				-: -	SA 150029,3
TUSKEGON	TUSAEGON COUNTY ANT MANS	. ***	14036 7753			1 1			
SAGIRAL	THI-GITY APT CAM	7	14640 7263			0192		•	4 715016 SA 713900
SAGZMALI	TRI-CITY APT CAM	ms l	14045	43 321		4 0185 C			SA 713880
SAGIRAL	TRI-CITY APT CAM	HE.	14045	43 327			1 49 - 12 54		T 152383.3
SAGIRAL	TRI-GITY APT CAR	77	14045	43 324		.,, -			5A T14236
TRAVERSE CITY	CHERRY CAR CAR	mr.	1-050	43 337				STAG ,	Tibede
YPSILANTI *	HILLIM SUM ART MEAS	#I	19857	42 146	. 542 238				SA 115290
A SACTOR 1	HILLOM PUR APT LEAS	m#	14053	42 146		1 1 -			715015
ALEXAHOR IA		- 1			. 202 759	0237 1	D 63 - 09 68 :	5744 5	A 152125.3
OULUTH	TUNICIPAL APT CAM	-	14010	45 52N	095 234	0-225			
DUL UTM	INTERNATIONAL ART WEAS		14913 7374	46 501					CB0017
OUL UTM	INTERNATIONAL APT LOAS		14913 7274	si⇔s son					A T1-005
ZI JOHA BARIT	INTERNATIONAL ART MORS		14913 7274	-6 SQN					A T15060.3
TINNEAPOL IS	INTERNATIONAL ART HAS		14922 72654						A T12751
ZI JDGA 3MKI	INTERNATIONAL APT MAS		4922 72654					THE M	SA 150097
MINNEAPOL IS	INTERNATIONAL MAT WORS		14922 72654					TAG (
MINNEAPOL 15	INTERNATIONAL ART WARS		4922 72654					TRE S	
4GCHESTER	FUNICIPAL ADT LARS		1 4972 7 2656 14925 72644		083 12H	0262 0:		TRG S	
Bilaxi			es> \20	43 558	G85 20M	0-02 0:	59 - 12 73 S	TAG	
gildri	SEESLER AFB	MS :	3620	30 2-44	088 550				
COLUMBUS	KEESLEB AFB	ms i	3820	30 246	388 554	2008 01	50 - 12 54 5	TAG M	T50775
COLUMBUS	ars		3825	33 38M	288 274			TRQ A	T50010
SHEENVILLE	4/5		3825	33 36%	088 27W			TRO SA	- 198413
JACKSON	THOMPSON FINE LINES		3939 72238	73 31M	091 COM			TOR SA	
JACKSON	THOMPSON THE LOAS		3940 12235	33 : SM	380 654			TRG SA	
JACKEDH	THOMPSON MAD LONS		3940 77235 3940 77235	32 19A	090 054			TRQ (3	752191 IN T14408
JACKSON	THOMPSON THE HOAS		3840 77235 3840 72235	32 19H	090 OSH	3110 01	55 - 12 69 5	TAG SA	
JACKSON	THOMPSON MAR LIGHTS		3940 72235		390 054	0110 01		TRQ 54	
JACKSON JACKSON	HALEINS FIELD WARS		2956 77235	32 198	390 13H(TRE SA	
THEKZON	HALKINS FIELD HORS	-1 -	3956 72235	32 20A	390 135			TRO AS	
FCCSFB	HALLINS FIELD HARS		3956 72235	32 20M	380 13M			rea 🚗	
MAIOIAM	STRE COUNTY CAN		3818	31 15#	380 5951			AQ ma	
HAIOIAH	CET FIELD WORS		3865 72234	32 20×	386 -SH			A2 DA' A2 B4'	
		- TS 13	3865 72234	35 30M	366 +5H	2090 21	70 - 12 70 57		
COLUMN TH	REGISHME APT LONS	~a a:	1044 30		ł	1		3M	T12925
COL UMB 1A	TUMICIPAL ART LARS			38 49m	385 12F		73 - 13 73 57	PQ	750200
SARSAS CITY	TUMICIPAL ART WAS	- 1 -		38 50m 38 188	085 55M	2538 31	54 - 12 66 57		713746
KAMSAS CITY KAMSAS CITY	TUNICIPAL ART LAKS		1900 72			2315 21	59 - 12 74 57	9Q 🚗	25333
SAMSAS CITY	TUNICIPAL APT LOAS		988 72-46	39 075		2221 21	54 - 12 54 ST		750692.3
SANSAS CITY	MURICIPAL ANT LOAS	1:	988 72446	39 97H		33381 31	57 - 12 71 ST		Tiares
SIRSVILLE	TURICIPAL ART MARS CRANGO TEMBRIAL ART		12445 T	39 07N	i		56 - 09 72 57 59 - 12 50 57		750635
SAIRT LOUIS	LAPREST FIELD WAS		1936	-0 06m	392 334	2294 21	59 - 12 59/ ST		112001
2414, C3012	LAPTERT FIELD WEAS		1994 77434	38 454	390 33H	0172 01	50 - 12 64 57		751867
SWIME FRAIS	LAPREAT FIELD LARGE	-, -	1984 72434 1884 72434	38 454	080 336	3172 01	64 - 12 58 ST		750284 711930.98
SHINT COUIS	LAMBERT FIELD WARS	= 1	994 72434		090 234	2125 61	35 - 12 69 ST		712039.2
34141 F3012 -	LATTERT FIELD LOAS		994 72434			0172 01	98 - 12 72 ST		750123
2414. C2017	LAPTREAT FIFTS Labor		984 72434			3177 01	59 - 12 59 STA	14 A	71200-
2414. 77012	LAMBERT FIELD LAGS		994 72434			3172 31	70 - 12 74 STR		751153.3
SPRINGF (ELD	APPEAT FIELD MORS		994 72434	-			70 - 09 71 575		713157
	TUNICIPAL APT WORS		905 77-40				70 - 32 71 STA	-	T11930
BILLINGS	COGAN FIEED LANG	_1	1	2	'	-200 1 01	55 - 12 70 STA	AZ PA	710182
SUTTE	SILVER SOM COUNTY ART CAR		033 72677		:08 324/ ;	:092 31 :	57 - 12 71 STA		*****
	CAR		135 72679	45 57M	112 304	1690 01	56 - 12 50 370		71-135
CUT BAHA	MAS THE JPRISTAUF		137		107 314 (3870 (a	98 - 75 SAİ STA		713365 714527
•	-		••'	*0 25%	112 22H	174 01 -	49 - 12 58 STR		750298
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CITY	Ser Sere - TYPE	ST.	-304		LAT	; and	: 5657	968:30 3F 866380	30 .378 97	SU/FI FREQ	-004/05:-004
L ASCOU L ASCOU	INTERNATIONAL ART HOAS	at at	34008	72768 72768	48 13M	126 374 106 374	0696 0696	01 55 - 12 50 01 57 - 12 71	5700 5700	5A 714	T\$1080.43
AVE	SITY-COUNTY RET HAS	ST	94012	72770	46 338	109 450	3758	01 57 - 12 71	STAR		714627
ELENA	HORS	. 97	24144	72772	46 367	112 004	1188	31 56 - 12 52	STAR	SA	713835
ELEMA	-005	21	24144	72772	46 258	112 304	1188	31 55 - 10 74	STAR	-	7:5236
al isaeil	SLAGIER PARK INL APT WARS	πī	24146	72779	48 ISM	114 15W	E905	01 50 - 12 52	STAR	ŞA	715061
AL ISPELL	SLACIER PARK THE ART WARS	ਜ਼ਾ	24146	72778	48 :57	114 164	2908	01 63 - 12 72	STAG	SA	T: 4723
EMISTOWN	MUNICIPAL APT FAA	77	2-035		47 338	109 27W	1263	01 67 - 12 71	STAR	.78 .78	T14627
ILES CITY	TUNICIPAL ART FAR JOHNSON-BELL FIELD WERS	AT:	24037 24153	72773	46 25N	105 52W	3802	01 57 - 12 71 01 57 - 12 71	STAC		714135 714627
INCOLN	4/8	₽€	14904	72551	40 5 IN	396 45U	3358	01 50 - 12 63	STAG	A	752091
STTAJO KTRD	LEE BIRD FIELD MARS	×€	3-023	72562	41 JEN	100 418	2848	01 50 - 12 54	STRE	Ã.	T14312
GRTH PLATTE	LEE SIND FIELD WORS	≈€	24023	72562	41 05R	100 -14	28-6	01 68 - 12 73	STAR	SA	T15169
STTAJS HTRD	LEE SIRO FIELD WORS	WE.	24023	72562	41 385	100 41M	28-6	05 73 - 09 75	STAR	/ 100	752015.3
MAHA	EPOLEY FIELD WORS	NE.	1 -645	72553	41 15H	095 5-W	0303	01 54 ~ 12 54	STAR	A	751932
	EPOLEY FIELD WAS	ME	1-0-45	72553 72553	41 16M	095 5444	0304	01 54 - 12 73	STAG	<u> </u>	T51298
TRIAN	EPPLEY FIELD WORK EPPLEY FIELD WORK	TE I	14843	72553	41 18M	095 544	0368	05 57 - 12 73	STRE		T52006 T01776
TAMP	EPPLEY FIELD WORS	ΝE	1-042	72553	41 189	395 5-44	0299	01 73 - 12 73	5788	-	T51020
THE STREET	OFFUTT AFS	ME	14040	72554	41 07N	085 554	0314	01 50 - 12 64	STAG	~	714312
DITTELLER	MUNICIPAL APT HORS	ME	24020	72566	41 52N	103 36W	1204	01 57 - 12 71	STRE	-	150563.3
STTSBLUFF	MUNICIPAL APT WAS	AE.	24028	72566	41 52N	103 358	1304	01 57 - 12 71	STAG	/-5	T14842
STTSBLUFF	MUNICIPAL APT LARS	ME	34020	72566	41 52N	103 36H	1204	01 68 - 12 72	STAG	SA ·	750256
40	FUNICIPAL APT FAR	NY	2 4121	72562	40 50N	115 47W	15-47	01 59 - 12 73	STAG	SA	751029
۲.	YELLARD FIELD WORS	AV.	23154	72466	39 17N	119 514	1907	01 67 - 12 71	STAG	SA	710065
S VERMS	MELLIS AFB	HV	23112		35 154	115 021	2573	01 58 - 12 57	STAG	□	715029
S YEGAS	MCGARRAN INL APT WOAS	MY	23159	72386	35 05%	115 100	0564	01 69 - 12 73	STAR	SA	750529 - 470
IS VEGAS	MCCARRAN INL APT HOAS	MY	23188	72386	36 058	115 104	C66+	01 58 - 12 73	STAG	SA	750529.47F
ee Yelocx	DERBY APT FRA	77	24172	75400	40 346	118 33M	1190	01 58 - 12 73	STAG	5A	751029
(PG ENG	STERO AFO INTERNATIONAL APT MARS	NV	23118	72466	39 40A 39 30A	119 524	1531	01 55 - 12 65	STAR		715029 752240
ING	ZAGE TOA JANGITANRITKI	MA	23185	72400	79 JON 100 BC	119 474	1343	01 60 - 12 60	STAG	-	T50878
NHETUCEN	MUNICIPAL APT MARS	MV	24128	72563	40 54N	117 484	1322	01 59 - 12 75	STAG	SA	T\$1029
MC380	MUNICIPAL ART WERS	MH	14745	72605	43 128	.071 JON	0104	01 50 - 12 64	STAG	•	715140.182
3HC3R0	MUNICIPAL APT WORS	MH	14745	72505	43 128	971 302	920-	01 50 - 12 54	STAR	-	T50303
MC390	FUNICIPAL APT WORS	MH (1-7-5	72605	43 12M	071 30H	0105	01 70 - 12 70	STAR	SA	T12925
etsigu fil	PERSE AFB	PH4	04743		43 Q5m	070 →9₩	3039	01 69 - 12 59	STAG	SA	T12926
LANTIC CITY	≥0 45		93730	72407	39 27N	374 354	0020	02 64 - 12 54	STAR	•	T52113
LANTIC CITY	works	NJ	93730	72407	39 277	07- 25-	0020	01 64 - 12 64	STAR	(7)	T13831
LANTIC CITY	≌8#\$	MJ.	93730	72407	39 27M	374 35H	0020	31 68 - 12 72	STAR	/™	T1-632
TLAMTIC CITY	MG#S	N.J	93730	72-07	39 27N	1074 25W	0020	01 70 - 12 74	STAG	A	752035
T HANG	455	NJ.	04739		40 11A	074 C4M	0026	01 55 - 12 59	STAR	77	T:338:
KEHURST	MAS	~~	14760	72409	40 02h	374 I9H	0036	01 68 - 12 72	STAG	SA	71.453D
LWOK	HGAS	7.1	14734	72502	40 42H	374 10M	0009	01 55 - 12 64	57 7 9	5A	T1261 2
emak Emak	HAAS	24	14734	72502	40 42M	074 10H	0009	01 60 - 12 64	STAQ STAG	SA SA	T14547.471
e samer E samer	1685 1685	2	14734	72502	40 42M	374 :04	0009	01 60 - 12 64	STAG	5A	714547.47K
ELAGE	HOAS	~	14734	72502	40 428	374 10H	2009	01 50 - 12 64	STAG	5A	T14547.47J
LIAGE.	HOAS	73	14734	72502	40 4ZM	374 10H	0009	01 66 - 12 .0	STAR	-	T12910
Chade	≔6 65	MJ I	14734	72502	40 42M	074 10W	3009	01 70 - 12 70	STAG	540	T12892
Chedic	-ans	7.4	14734	72502	40 42M	974 ±9₩	3009	31 71 - 12 71	STAG	SA	T\$0200
0008037	SALIR	7.	94741		40 51#	074 03W	0002	01 52 - 12 56	STRE	-	T12910
ICHTSTOWN	ACCRINE WAR	~-	14706		40 00M	074 362	00-15	01 56 - 12 70	STRE	SA	T15100
SUBUE SOUE	SUM-KIRTLAND INL APT MARS	86	23050	72365	35 038	106 374	1519	01 60 - 12 64	STAR		T14164
SUGUERQUE	SUM-KIRTLAND INC APT HOAS	201	23050	72365	35 J3M	105 374	1519	21 75 - 12 75	\$78 Q		752113
RMINGTON	MUNICIPAL APT CAN	201	22090		36 - 56 26 -456	108 1-4	1577	01 54 - 12 59	STRE STRE	5A	T13029 712160
IGMINGTON ILLUP	MUNICIPAL ART FAR SEMATOR CLARKE FIELD SALE	70	52001 52030		25 218	108 1-4	1970	01 75 - 12 75	5789		752176
662	LEA COUNTY APT CAA	200	93034	1	33 31N	103 124	1117	31 49 - 12 49	STAG	-	T52339
885	LEA COURTY APT CAR	56	93034	- 1	32 41N	103 124	1117	01 49 - 12 54	STRR	- 70	71-0-0
1885	LER COUNTY APT CAR	200	93034		32 41H	103 124	:117	01 53 - 12 54	578Q	SA	T\$2339
S SHUCKS	LALITE SANOS AF	86	22029	72269	32 22M	:08 294	1291	01 51 - 12 55	STAG	. 	T52245
MTM FE MS	CAA INTERMEDIATE FIELO FSS	9E	230 44	1	39 379 35 08N	106 754	1925	01 50 - 12 54 01 57 - 12 71	STAG	 	752246 714358
						i		J			
AARY AARY	MURICIPAL ART WAS	MY	14775	72510	42 458	073 46W	0000	01 50 - 12 54	PATZ PATZ		T1-513 T12910
SARY	MUNICIPAL APT WORS MUNICIPAL APT WORS	77	14735	72518	42 45H	073 484 i	2090	01 56 - 12 70 01 57 - 12 71	STRE		712910 714364+115G
THAE.	TURICIPAL APT WAS	77	14735	725181	42 458	373 -dui	3090	01 57 - 12 71	5790	5A	::-384+119G
BART	MUNICIPAL APT WEAS	77	14735	72518	42 458	073 -6H	2090	21 67 - 17 71	STRE	SA	714364.I15A
8444	· "MURICIPAL ADT LAAS	AY	14735	72518		373 48H	0090	31 57 - 12 71	5798	5A	714354-115C
TRAC	TURICIPAL ART WAS	37	14735	77518	42 45M	075 484	3380	01 57 - 12 71	STAG		T14364.:15H
SANY	MUNICIPAL PPT WARS	AY	14735	72516	42 458	073 46H	0090	01 57 - 12 71	57 84 57 48		714364,47F 714364,1158
AARY	TURICIPAL RAT WARS	77	14735	72515		073 48W	2080	31 67 - 12 71 01 67 - 12 71	STAR		T14364.1158 3611.468CFT
5497 5497	TURICIPAL ART WOAS TURICIPAL ART WOAS	AT	14735	72518	42 45R	373 -6H	2090	01 72 - 12 72	STAG		13-36-135C
HCHAMTON	SAGGME COUNTY APT LAMS	74	04725	72515	42 138	075 5GH	0493	21 80 - 12 64	STAR		T1 4640
RGH ARTU R	SROOME COUNTY APT WORS	AT	04725	77515	42 :34	075 50H	0493	01 64 - 12 64	STAR	SA	701772
HUTBANUE	SHOOME COUNTY HAT WORK	AT	04725	77515	42 138	075 500	0493	31 64 - 12 54	PAT2		750-08
NGHAFTON	TRI-CITIES APT WEAS	MT	14738		42 05N	075 084	3254	31 50 - 12 50	PATZ		T50408
JFFAL O	GTR SUFFRED INC APT WARS	HY	14733	72528	42 56A	078 444	3215	01 54 - 12 731	STRE		T50358
IFFAL O	GTR SUFFRES INC APT WARS	AT	14733	72528		078 444	0216	31 67 - 12 71	STAG		T31772
JEFALO STALO	STR SWFFRLS INL GOT WORK	MY	14733	72528		079 444	0518	31 57 - 12 71	9472		71 445 2
)FF4L3	STR BUFFALD INC APT WOAS	27	14733	775251	42 56M 42 10M	376 54H	0218	01 73 - 12 731 01 50 - 12 541	STRE		750847.3 751195.3
.HIRA	ARS THE YTHUES DHUMBHO ARS THE THUUES KBRAA	77	14750	72516	43 21R	376 37W	0184	01 50 - 12 54	5784 9472		751195.3
				1							
.EMS FRUIS De Tork	LA GUAGOIA APT -645	371	14732	72503	40 45#	073 SZM	0015	31 51 - 12 50	STAR	A	T1 4022

2277	74FC - TYPE	\$7	H0444	are) T	1 LAT	LON	a, ELE	=€9100		UTTART	SUCT
*EH 7394	LA SUARDIA ART HOAS		1				 -		• •	17PE	FRC3 "464/86"4965
ACH AGGE	LA SUPROIA APT LOAS	NY NY	14732	77503 77503			;			TAG	5A 71-068
463 - 400K	LA SUARDIA HOT LASS	97	14732	72503	40 460		44 201			TAQ Taq	9 712795 SA 714668
PCM TORK	TH CHHOOTH WELL HOW?	77 77	14732	72503 72503				2 01 56 - 12	70 5	TRE	712910
ייבש אמפג ייבש אמפג	LA GUAGOIA ART WORS	AT	14732	77505	40 46		-W 301			TAQ TA Q	A 713660
PEN TORK	LA SUARDIA APT WARS LA SUARDIA APT WARS	77 77	14732	72503	40 461	9 272 5	→ ⊔ 301	2 01 71 - 12		TAG	\$A 714069 A 713660
™EM YGGK ™EM YGGK	LA GUAROJA APT WAAS	AT	14732	72503 72503	40 45		44 001	2 12 71 - 11	_	TRE	SA T14745
SEN AGES	LA SUARDIA APT WAS SERTARL SARK WAS	AT	14732	72503	40 450					TAG TAG	SA T50003 SA T51951.3
SCH AGEK	J F CEMPEDY INL ANT WAR	NY Ny	94725 84769	7-446	40 47A		8⊷ 00-	0 31 56 - 12	70 S	TAG	75A 7135-0.40
הבה גמטל הבה גמטל	I F KEMMEDY IML AGT LEAS	AT	34799	74466	+0 39A		74 001				SA 714059
PROV HOSE	J F KENNEDY INL NOT WORS		34789	74-06	40 38N		74 001				SA T:2751 SA T:4069
NEW FORK	J F KENNEDT INL AGT WARS	NY	34789 34789	74486 74488	40 39M				70 5	AQ .	712910
YEM YORK MEMBURGH	I F KENNEDY INL APT WAS STEWART AFE		94788	7-100	40 18N						SA 714060 SA 751051.4
≈€ыецясы	STELMAT AFE	77	14714	74462	41 30H	074 Q6	017	7 01 55 - 12			C.129167 AZ
MEHBURGH MEHBURGH	STELMAT AFE	77	14714	74462	41 30M		-,				SA 750251.115H
™E¥&URGH. ™E¥&URSH	STEWART AFE STEWART AFE	77	14714	74402	41 30N	374 CE					SA 750251.1156 SA 750251.115A
=€H8U9QH	STEMAT AFE	AY	14714	74482	41 307		P 0177	7 01 65 - 12	68 57		3A 750251.1158
₩€₩₽₽₽₩ ₩€₩₽₽₽₽₩	STEHART AFE	AT	14714	74462	41 30A	274 06 074 28					T12910
uc monach	gra Traudita Structure	77	14714	74482	41 30M	074 06			60 57	_	SA 750291,47F SA 750291,119G
MIRGRAM FALLS	MISSILE SITE AF	AY	147 (4	74462	41 38M 43 86	374 08		7 01 55 - 12	59 ST		SA 750251,470
POUDHEEPSIE	MUNICIPAL APT	NT	94731	74484	43 27m	978 57 975 98			50 ST		T51195+3
ROCHESTER	COUNTY APT CAA	77	14757		41 384	373 53	L 00-4		541 57		* 750426 ** 712910
ROCHESTER	TOPOC COUNTY APT LOSS	NY	1 4756 1 4756	72529	43 07H	077 40 077 40		01 55 - 12	64 ST	89 -	TSA T50221
AGCHESTER AGCHESTER	FORMOE COUNTY APT HEAS	AT	1 4766	72528	43 07H	077 40			54 ST	-	5A T14580 5A T14237.1150
40CHESTER	TORROS COUNTY ANT HORS	AY	14766 14766	72528 72529	43 G7R	077 40	0167	01 67 - 12	71 ST		5A T14237-115C 5A T14237-1156
POCHESTER POCHESTER	MORROE COUNTY APT LAS	AY	14756	72529	43 07N	077 40:			71 577	-	A 714237+115E
ROCHESTER	MONROE COUNTY ART LONG MONROE COUNTY ART LINES	AY	14758	72529	43 07H	077 40			71 57	-	iA T14237.47F IA T14237.115G
ROCHESTER	HORAGE COUNTY ANY MARS	MY	14758	72529	43 37N	077 401	-,	01 67 - 12	71 571	14 S	
AGCHESTER AGCHESTER →	MONGOE COUNTY APT HANS	HY	14756	72520	43 Q7N	077 400 077 400		1 27 22 -	71 ST	_	A 714237.47Ġ
AGRE	MERROE COUNTY NOT LONS CRIFFISS AFE	MT	14756	72520	43 87 ₩	077 40I	0187	1 27 22	73 57		
STRACUSE	C E MARCOCK APT LOAS	AT	14717	72518	43 :44 43 07#	975 254	1		70 574		
SYRACUSE SYRACUSE	C E HANCOCK ART LGAS C E HANCOCK ART LGAS	NY	14771	72518	43 071	375 071		1 22 22 72	64 STA 64 STA		
SYRACUSE	C E MANCBCE ANT LIGHT	27		72919	43 07R	076 076	0159	01 67 - 12	67 STA		
· MATERIONA HAITE PLAINS	MUNICIPAL ART FEE		94790	72519	43 07W	076 37L			73 57=		
"WITE PLAINS	HESTCHESTER CAP SALE HESTCHESTER CAP SALE		94745	1	41 344	073 43L		01 60 - 12	54 STR		:
-		77]	94745		41 0-44	073 436	0125		72 STA		750556
=SHEVILLE ASHEVILLE	MURICIPAL APT WARS				35 26M	082 126	0859	01 56 - 12	70 579	4 54	
CAPE HATTERAS	140				35 265	383 334	0650	91 71 - 12 1			
CHARLOTTE CHARLOTTE	DOUGLAS PRO LAMS				35 16M	075 334 080 564	,		TO STA		
CHARLSTTE	ODUGLAS THE LEAS ODUGLAS THE LEAS				35 13N	C80 55M	,		GA STR		
CHARLBITE	DOUGLAS MAP LIGAS			,	35 13M	380 56M	0226		TO STR	Q 5a	T505-44
CHARLOTTE CHARLOTTE	CONCEAS WE FORS		13861	77314	35 13M	280 564	0236		O STA		712761 750464
CHERRY PRINT	MCAS				35 ;3R 34 548	080 56M	0224	01 73 - 12 7	3 STA		
FORT SEAGG SOLOSBORG	SOPE AFE				34 54H 35 11N	078 53M	0061	01 67 - 12 7 01 66 - 12 7	1 STA		
GPEE758098	SETTOUR JOHNSON AFB GREENSAGRO HI OT ART WARS		13713	:	35 20H	077 50M	3037	31 55 - 12 7	-1		714256 714256
JEEE738090	GREENSBORD HE OT APT WARS	-,			36 05# 36 05#	379 574 379 574	0275	01 55 - 12 7	- 1	3 SA	T12761
GREENSOORO CREENSOORO	CREEKSBOOK ME OT APT WORS	NC :	3723		36 Q5M	379 57W	0275	31 66 - 12 7 31 73 - 12 7			T1-547
PALEIGH	CREENSOURD ME OF APT HORS					379 57W	0273	10 73 - 08 7	_,	• • • • • • • • • • • • • • • • • • • •	750857 750795
PALEIGH	PARL TOR MANDUC WELZJAS	-1 -			35 52M 35 52M	378 47W	0132	31 55 - 12 5		\$A	T12310.108
aureich Aureich	PACEIGH DURMAN ART WAS		3772 7	2306		078 47W	0125	01 55 - 12 5			712310 712310
≅1L⊓INGTON	MEN HAROVER ART WERS			1 -		078 47W	0132	91 56 - 12 7	STAG	SA	T12310.108 T12761
HILMINGTON HINSTON SALEM	ZADU TRA ESVERAL LISA					977 55H	0014		DATE D	SA.	T12761
	SMITH REYMOLDS APT LOAS	4C 8				000 144	0303				751279.a 714587
3/SMARCE	FURICIPAL ART MARS	70 2	 011 7	2764	-6 -6M	:00 454	0507		1	_	
DICKINSOM MINOT	PUNICIPAL ART FAM INTERNATIONAL ART FAM	*0 2	-012			103 464		01 67 ~ 12 7: 01 60 - 12 5:	STAQ		T13923
WILL ISTOR	SCOUCIN FLO INC ART MAS		4013 4014 7	2757	B 164	101 174	0526	Q1 57 - 12 7	t STAG		71 4627 71 4 627
AKADM		-		1/9/ 7	HB 138	:03 38H	0581	31 57 - 13 7	STAQ	~	T1-627
94.80#	PERSN-CANTON APT WORS				40 SSM	781 76W	0379	21 60 - 12 64	STRE	SA	750149
44404	PERGH-CANTON APT WEAS					281 25W 381 25W	0279	01 54 - 12 75	STAR	SA	750805.3
AKROM AKROM	ARRON-CANTON ANT LOS	3H 1	4895 7	2521 4		081 26M		Q1 70 - 12 74 Q1 70 - 12 74			T15675.3
AK DUM	ARRON-CARTON ART WARS			2521 4	10 55N (101 26H	2379	01 73 - 12 73	STAR	5A	T51253.3 T51144.3
aredu Aredu	PARCH-CARTUR APT LEAS	3H 1-				361 36W		01 73 - 12 75 01 74 - 12 74		Ā	T1-900
CLEVELAND	ACRON-CANTON ART WORS HORKING INC ART WORS	JM 1-	4995 7	?521 →	C 55N C	361 25W		DI 75 - 12 75		5A 5A	715675+3 752408+3
CLEVELAND	HOPKINS INC ART WOAS		4620 7: 4620 7:	2524 4 2524 4		51 51W	3247	31 54 - 12 54	STAQ	À	750064
SLEVELAND CLEVELAND	HOPE INS INC APT LOAS	3H :-	-820 72	2524 4	1 244	81 51H	2247	01 55 - 12 57 01 65 - 12 57	STAR	а 5а	T11936
CLEVELARO	MOPRIAS INL BOT LOS			524 4	1 240 5	181 SIH	3247	01 57 - 12 71	STRE	28	T11963 T01772
CLEVELAND	HOPKING INC HOT LOAS			1524 41 1524 41	1 248 C 1 248 C	81 51W	3247	91 59 - 12 75 91 69 - 12 59	STAG	9	790959-3
					. •			:2 59	STAG	SA	T11963
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	- 3445 - 3HDF	57		* !					 _	SA	752044
CLEVELAND	AGRETHS INC POT MARS	314	14620	72524	41 244	281 51M	3247	01 70 - 12 74 01 70 - 12 74	5729 5729	SA	7:5675-3
CL EVCL ARD	HOPE THE APT HOPE HOPE THE APT HOPE	3H	: 4520	72524	41 244	381 51W	3247	21 70 - 12 70	STRE	4	701772
CLEVEL AND	HOPE INC APT WAS WEED AND APP WEEDS	3#	: -920	1252-	41 244	381 514	3247	DI 70 - 17 70	STAR	4	714525
CT EAST WAD	HOPKINS INL ART WORS	3#	: -920	77524	41 248	281 SIM	3247	01 72 - 12 72	STAR	a A	714 57 750705+3
CLEVEL AND	HOPEINS INC APT HOPS	3H	: 4020	72524	41 244	281 51M	3245	01 73 - 12 73	STAR	SA	T15351.3
CLEVELANO	HOPKINS INC APT HORS HOPKINS INC APT HORS	HC	; 48 20 1 4820	72524	41 249	081 51H	0249	31 75 - 12 75	STAR	S.A	~52~C2+3
CLEVELAND COLUMBUS	PORT CULUMOUS APT HOAS	38	: 4921	72429	40 00M	202 324	0253	21 50 - 12 54	57RQ	SA SA	751830 ' 714132
COLUMBUS	DORT COLUMBUS APT LOPS	Эн (: 4621	72426	40 000	082 53M	0253	31 50 - 12 54 01 70 - 12 74	STAR	SA	715675+3
COLUMBUS	AGRT COLUMBUS ART LOAS	3H	14021	72426	40 00M	082 534	0253	01 74 - 12 74	DAT2	SA	715675+3
COLUMBUS	POST COLUMBUS APT WAS POST COLUMBUS APT WAS	3H	1-021	72428	40 00M	282 534	0293	01 75 - 12 75	SALS	54	752409+3
C3LUFBUS DAYTBA	J H COX-ORYTON MAD WEES	Эн	93815	77429	,38 744	C84 134	6212	01 55 - 12 59 01 59 - 12 59	STAR	SA SA	T11963 T11963
DAYTON	J M COX-DAYTON MAP LEAS	314	23815	72429	38 548	084 13H	2313 2308	01 50 - 12 50 01 50 - 12 73	STAR	a)	750959-3
PETTAC	J M COX-OMYTON MAP WORS	3H	93815 93815	72429 72429	38 5-M	084 139	0306	01 70 - 12 74	STAG	SA	T15675.3
METTAC	J IN COX-DAYTON INP WORK	314	93815	72439	39 544	084 13M	0206	01 73 - 12 73	STAR	2	715022 750950+3
DAYTON	I H CEX-DAYTON THE LOAS	34	33615	72429	39 54H	084 134	0206	01 73 - 12 73	STAR	-	751267
DAYTON	J M COX-DAYTON THE MORS	QH I	22815	72428	38 54M	134 1451 +80	0306	01 74 - 12 74	STAG	SA	T15675 - 3
DAYTON	J M COX-ORYTON MAP HARS	OH!	93815 93815	72429 72428	38 544	084 134	0306	01 75 - 12 75	STAR	SA	752409+3
DAYTON	J M COX-DAYTON MAP WOAS CAA	32	: 4625		41 018	363 40W	0344	91 50 - 12 54	STAG	•	713709
FINOLAY	CAA	gn4	1-025		41 018	083 402	0345	01 90 - 12 54	BRT2 BRT2	S#	750789+3 752126+3
FINGLAT	CAR	314	14635		41 017 40 48M	083 31P	0244	01 50 - 12 54	STAG	5A	715675 - 3
MANSFIELD	LANN MUNICIPAL BOT FAR	3H (14691		40 498	365 31H	0397	01 74 - 12 74	STAG	SA	7:5675.3
MASS IELO	LAMM MURICIPAL ART FAR LAMM MURICIPAL ART FAR	311	1-021		40 49N	362 314	0397	21 75 - 12 75	STAG	SA	T\$2409+3
Henzi ieto	CAR MUNICIPAL AND FAM	311	1-0-13		41 47N	QS: 06W	0211	01 49 - 12 48	STAR	4 5A	750875.3 752126.3
TOLEDO	EXPRESS ART MORS	314	3~43 38	72536	41 368	083 494 WB+ EBO	2211	01 50 - 12 64	STRE	5A 5A	712221
TOLEDG	EXPRESS ART WARS	GH	94630	72536 72536	41 354	263 46W	0211	06 58 - 05 70	STAR	SA	T: 2221
TOL COO	EXPRESS ART WARS	34	84830 84830	72536	41 388	- 083 48M	0211	31 70 - 12 74	STAG	SA	115675 - 3
TOLEDO TOLEDO	EXPRESS APT WARS EXPRESS APT WARS	311	34030	72536	41 368	383 46H	0211	01 75 - 12 75	STAG	SA SA	751144+3 715675+3
TOLCOO	EXPRESS OFT MAS	314	94630	72538	41 36M	083 4 9 H	0211	01 74 - 12 74	STAR	5A	752409+3
TOLEDO	EMPRESS APT LOAS	394	94630	72536	41 36M	363 464 080 404	0211	01 67 - 13 71	STRE	5A	701772
TOURGSTOL	MUNICIPAL APT WARS	3H (14652	72525	41 150	280 404		01 70 - 12 74	STAG	5A	T15675 • 3
YOUNGSTOLM	MUNICIPAL MAT LARS	314	1-652	72525	41 16N	080 -QM	0365	01 73 - 12 73	STAR	~ A SA	114000 115675.3
70UNGS70WM 70UNGS70WM	PURICIPAL APT LEAS	314	1-652	72535	41 16M	060 40H	3385	91 74 - 12 74 91 75 - 12 75	STAG	SA	752409-3
YOUNGSTON	MURICIPAL APT WERS	3H (14852	72535	41 15M	360 40H	0365	1 41 /3 - 12 /3] ••••		
		35	13909		36 20N	087 5 4 4	0383	01 65 - 12 50	STRG	SA	T12761
ENID	VARCE AFB	B#4	93950		34 53M	195 474		01 54 - 12 54	STAG	744 5.6	751627+3 T12697
MCALESTER DELANDMA CITY	TIMER OF B	35	12818	72354	35 25H	097 234	2284	07 65 - 06 70		36	751200-3
OKLAHOMM CITY	HILL ROCERS APT HARS	35	13967	72353	35 247	097 364 097 364			STAR	-	T51200+3
POHCH CITY	MUNICIPAL APT CAR	3K.	13968	72356	1	295 544	1	01 55 - 12 74	STAR	7	T51827.3
TULSA	INTERNATIONAL ART WAS INTERNATIONAL ART WAS	35	13968	72356		095 544		01 62 - 12 71	STAR	75A	TQ1772 T51200-3
TULSA TULSA	INTERNATIONAL APT WORS	35	13956	72356		095 5-44	0206		STAR STAR	(70	750430.3
TUL SA	INTERNATIONAL ART WAS	95	13968	72256 72356		095 5-44 085 5-44	0206	1		75A	T50967
TULSA	INTERMATIONAL AAT WOAS	34	13960	.2350	30	-		İ	1		T12945
ASTONIA	CLATSOP COUNTY APT WAS	3€	34324	72791						5A	714469
EUGENE	HANGEN-SHEET FIELD WERS	g 🖴	24221	72603	42 09N	153 138			1	ms.A	T12273
KLAMATM FALLS	KINGSLEY FIELD AF	3R 3Q	94235		42 09R	121 444				m3A	T12273
KLAPMIN FOLLS	KINGSLEY FIELD AF LACKSON COUNTY APT WARS	39	24225	72597	1			01 70 - 12 74		^	752145+3 752143+3
≒EDF3RO r€DF3RO	JACKSON COUNTY APT WOAS	39	24225	72587				01 73 = 12 73 01 73 → 12 74		3A A	752143.3
-EDF 090	JACKSOM COUNTY APT LOAS	38	24225	72507				1		1989	T1-034
PEHOLETOR	SENGLETOM FIELD MORS INTERMATIONAL ART WORS	JR JR	24155	72566 72596					1 -	54	T13530
200 T. APO	SHOW THE JOHN THRESTRI	39	24226	72696						A	750372 714634
AED ron	ROBERTS FIELD CAR	38			44 15F					SA	714469
SML ETT	PENARY FIELD HOAS	3R	34525	72594	₩ ~~ 558	123 018	0091	u	1		
	SETHLEHER EST APT HARS	20	14737	72517			9117			SA SA	7135 45 715347.3
ALLENTOWN ALLENTOWN	SETHLEHEM EST APT WORK	PA	14737	72517				01 54 - 12 73 01 55 - 12 58		5A	712540
ALL ENTOWN	SETULEHEM EST ART WARS	99	14737	72517					STAR	SA	T15347.3
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offfatare	SLAIR CAP PET HEM FLD CA	4 24			40 185						T13909
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CBIE CBIE	CAD TOA JANEET TANGETH:	74	1-050	7252					STRE	5A	752-09-3
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PITTSBURGH	ALLEGHENY COUNTY ART	PA	14781	72512	40 53M	378 35	W 2586			\$A 751936.3 \$A 714015
PITTSBURGH	STR PITTSBURGH ART LAKS	24	14762	72520	40 218	279 56		91 74 - 12 75		SA 752345.3
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PITTSBURGH	GTR PITTSBURGH APT WAS	24	94023	72520	40 30#	C80 131	_,		STAG	\$4 715347.3
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PITTSBURGH	GTR PETTSBURGH ART HARS	20	84653	72520	40 30N	CGO 121		01 57 - 12 67	STRO	↑ 7144Q7
PITTSBURGH	GTR PITTSBURGH ANT HARS	PR	3-623	72520	40 30n 40 30h	080 131	1		STRE	A 714407
PITTSBURGH PITTSBURGH	GTR PETTSBURGH ART WORS	24	94623	77520	40 30N	080 121			STRQ	7118QZ
PITTSBURGH	GTR PITTSBURGH APT WARS	24	7-023	72520	40 30N	C80 131			STRE	SA T15347.3 8 T50058
PITTSBURGH	GTR PITTSBURGH APT WORS	PA PA	94933	72520	40 30×	380 :31			STRE	* T50959 * T10680
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PITTSBURGH HDRUBZTT1	GTR PITTSBURGH APT WARS	Pe	9-623	72520	40 30M	380 13F			STAG	A 101772
PITTSBURGH	GTR PITTSBURCH MAT WAS	Pa ·	9-073	72530	40 30M	280 131			STAQ	A 701772
PITTSBURGH	GTR PITTSBURGH APT HARS	PR I	94623	72520	40 30H	C00 136	2273	01 73 - 12 73	STAG	75 TQ1772
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PITTSBURGH PITTSBURGH	CIR PITTSBURGH APT WAS	PR	8-653	72520	40 30H	080 13H			STRE	SA . T15675.3
PITTSBURGH	GTR PITTSBURGH MET HOMS	24	94623	72520	40 30%	280 125		01 74 - 12 74 01 75 - 12 75	STAG STAG	5A 751936+3
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MILKES-BARRE	HORS SCHAFTON	Pa	14712 14777	72510	40 23#	075 58W	2096	01 40 - 12 40	STRO	5A 71359
MILTES-BARRE	LOAS SCRATTON	PR	14777	72513	41 20M	075 444	0293	01 60 - 12 64	STRE	SA 714643
Mires-94466 .	HOPS SCRANTON	20	14777	72513	41 20M	075 444	0360	01 64 - 12 73	STAR	SA 715347.3
38886-531 JIM	LOAS SCRANTON	Pet I	14777		41 JON	275 444	0269	91 60 - 12 79 91 71 - 12 75	STAG	5A T15347.3
HILKES-BARRE	WARS SCHARTER	200	14777	72513	41 20M	375 44W	0269	01 73 - 12 73	STAG STAG	79 T51940 54 T15347.3
MILLIAMSPORT	LYCOMING COUNTY ART HOAS	PR PR	14777		41 20M	975 +44	3288	01 74 - 12 74	STAG	5A 715347.3 5A 751936.3
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mirribus Gadae	LYCOMING COUNTY APT HORS	28				975 55W	0160	01 59 - 12 73	STAR	SA T15347.3
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PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS	11 11 12 12 14	1-765 1-765 1-765 1-765 1-765 1-765 1-765 1-765	72507 72507 72507 72507 72507 72507 72507 72507	41 4400 41 4400 41 4400 41 4400 61 4400 61 4400 61 4400 61 4400 61 4400 61 4400 61 4400 61 4400	271 75H 071 25H 071 25H 071 25H 071 25H 071 25H 071 26H 071 26H 071 25H	0018 0019 0019 0019 0019 0019	31 50 - 12 64 31 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 36 72 - 08 72 31 74 - 12 74 31 74 - 12 74 31 74 - 10 74 31 54 - 12 56	STAQ STAQ STAQ STAQ STAQ STAQ STAQ STAQ	SA 71-0118 TR 17-01370 SA 71-01370 SA 71-0139 TR 17-0139 TR 17-017-02 TR 17-017-03 TR 17-017-03 TR 17-017-03 TR 17-018-03 TR 17-018-03 TR 17-018-03 TR 17-018-03 TR 17-018-03 TR 17-018-03 TR 17-018-03 TR 17-018-03
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PROVIDENCE PROVIDENCE	T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS ANDERSON GRUNTY ABY CRA MUNICIPAL ABY WARS MUNICIPAL ABY WARS MUNICIPAL ABY WARS MUNICIPAL ABY WARS MUNICIPAL ABY WARS MUNICIPAL ABY WARS MUNICIPAL ABY WARS	#1 #1 #1 #1 #1 #1 #1 #1 #1 #1	14765 14765	72507 72507 72507 72507 72507 72507 72507 72507 72206 372208 372208	41 448 41 448 41 448 41 448 41 448 61	271 254 071 254 071 254 071 254 071 254 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264	0018 0019 0019 0019 0019 0019 0019 0018 0018	21 50 - 12 64 21 50 - 12 73 21 56 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 54 - 12 56 21 60 - 12 54 21 60 - 12 72 21 70 - 12 70 21 72 - 12 72	STAQ STAQ STAQ STAQ STAQ STAQ STAQ STAQ	SA 71-0118 79 750379 3A 71-0128 3A 71-025 3A 71-025 79 71-025 71-1902 71-1902 71-1903 71-1903 71-1903 71-1903 71-1903 71-1903 71-1903 71-1903
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS	20 20 20 20 20 20 20 20 20 20 20 20 20 2	14765 14765	72507 72507 72507 72507 72507 72507 72507 72507 72208 372208 372208 372208	41 4444 41 4444 41 4444 41 4444 41 4444 41 4444 41 4444 61 444	271 264 071 264 971 264 971 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 082 434 080 024 080 024 080 024	0018 0019 0019 0019 0019 0019 0019 0019	31 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 74 - 12 74 31 54 - 12 56 31 60 - 12 54 31 60 - 12 54 31 70 - 12 70 31 72 - 12 70 31 72 - 12 70 31 72 - 12 72	STAQ STAQ STAQ STAQ STAQ STAQ STAQ STAQ	SA 71-0116 TR 150370- SA 71-0105 SA 71-005 SA 750655 TR 13002 TR 150725 A 752-4-0 SA 751176-3 T 125-0
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINCIPM, ABT WARS TWINGIPM, THE	#1 #1 #1 #1 #1 #1 #1 #1 #1 #1 #1 #1 #1 #	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14860 13880 13880 13880 13883 13883 13883	72507 72507 72507 72507 72507 72507 72507 72507 72208 72208 72208 72208 72208 72208 72208 72208	41 4444 41 444	271 254 071 254 071 254 071 254 071 254 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264	0018 3018 0019 3019 3019 3019 3019 3019 3019 3018 3018 3018 3075	21 50 - 12 64 31 64 - 12 73 31 66 - 12 73 31 72 - 12 72 01 72 - 12 72 06 72 - 08 72 31 74 - 12 74 01 74 - 12 74 01 74 - 12 56 31 50 - 12 54 31 50 - 12 54 01 70 - 12 70 31 77 - 12 72 31 57 - 12 75 31 57 - 12 75	STAG STAG STAG STAG STAG STAG STAG STAG	SA 71-0118 TR 17-0128 SA 71-0128 SA 71-023 SA 71-023 T 13-02 T 13-02 T 13-02 SA 71-2-0-0 SA 71-2-0-0 SA 71-2-0-0 SA 71-2-0-0 SA 71-2-0-0 SA 71-2-0-0 T 1-0-1-0 SA 71-0-1-0
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON COUNTY APT CAM MUNICIPAL ABT WARS	#11 #11 #11 #11 #11 #11 #11 #11 #11 #11	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14860 13880 13890 13900	72507 72507 72507 72507 72507 72507 72507 72507 72507 72507 72507 72507 72508 372208 3	41 4444 41 4444 41 4444 41 4444 41 4444 41 4444 61 4444 61 4444 61 4444 61 4444 61 4444 61 4444 61 4444 61 5444 61 544	271 26W 071 26W 071 26W 071 26W 071 26W 071 26W 071 26W 071 26W 071 26W 071 26W 080 02W 080 02W 080 02W 080 02W	3018 3019 3019 3019 3019 3019 3018 3018 3018 3018 3018 3018	31 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 74 - 12 74 31 54 - 12 54 31 60 - 12 54 31 60 - 12 57 31 77 - 12 72 31 66 - 12 71	STAQ STAQ STAQ STAQ STAQ STAQ STAQ STAQ	SA T1-0118 TR T50370- SA T14703 SA T14703 SA T90855 TR T13802 TR T50725 A T52440 SA T51176-3 A T52440-52 SA T12865 SA T12818 T1-015 SA T12919 TR T1-015 SA T14140 SA T14140 SA T14140
PROVIDENCE PROVIDENCE	T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS T F GREEN ABY WARS THOUSE ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL ABY WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIPAL THINICIPAL WARS THINICIP	20 20 20 20 20 20 20 20 20 20 20 20 20 2	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14860 13880 13890 13900	72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72508 3 72208	41 448 41 48 41	271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 280 224 280 224 280 224 281 274 281 274 281 274 281 274 281 274	0018 0019 0019 0019 0019 0019 0019 0019 0019 0018 0018 0018 0079 0075 0075 0075	21 50 - 12 84 21 64 - 12 73 21 68 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 54 - 12 54 21 80 - 12 54 21 80 - 12 72 21 72 - 12 72 21 73 - 12 72 21 80 - 12 77 21 70 - 12 71 21 66 - 12 71 21 66 - 12 71 21 70 - 12 72 21 70 - 12 73 21 70 - 12 73	STAQ STAQ STAQ STAQ STAQ STAQ STAQ STAQ	SA 71-0118 TR 17-0179 SA 71-018 SA 71-023 SA 71-023 T1-023 T1-023 T1-025
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PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS TWINICIPAL THE ABT WARS	######################################	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 12880	72507 72507 72507 72507 72507 72507 72507 72507 72507 72508 72208	41 4-48 41 4-4	271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 280 224 280 224 280 224 281 274 281 281 281	0018 3019 0019 2019 2019 2019 3233 3018 0018 3018 0018 3018 3018 3018 30	21 50 - 12 84 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 25 74 - 10 74 21 54 - 12 54 21 66 - 12 72 21 72 - 12 68 21 67 - 12 72 21 57 - 12 68 21 57 - 12 68 21 57 - 12 72 21 57 - 12 72 21 57 - 12 73 21 50 - 12 74 21 50 - 12 74 21 50 - 12 75 21 50 - 12 54 21 50 - 12 54	STAGE STAGE	SA 71-0118 TR 17-0129 SA 71-0129 SA 71-0129 SA 71-0129 TS-01-0129 SA 71-129-19 SA 71-129-19 TI-01-19 T
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS WARDER ABT WARS WARDER ABT WARS WARDER ABT WARS WARDER ABT WARS WARDER ABT WARS WARDER ABT WARS TWARDER ABT WARS TWARDER ABT WARS TWARDER ABT WARS TWARDER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS TWETTER THAN ABT WARS THE THAN	######################################	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 12860	72507 72507 72507 72507 72507 72507 72708 377208 377208 377208 377208 372208 3	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 284 371 284 380 324 380 324 380 324 380 324 381 374 381	0018 3019 0019 2019 2019 2019 2019 2018 0019 2018 0019 2018 2018 2018 2018 2018 2018 2018 2018 2018 2018 2019	31 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 54 - 12 54 31 66 - 12 72 31 66 - 12 72 31 77 - 12 66 31 67 - 12 71 31 68 - 12 71 31 68 - 12 71 31 68 - 12 71 31 68 - 12 71 31 68 - 12 71 31 68 - 12 71 31 50 - 12 54 31 50 - 12 54 31 50 - 12 57 31 50 - 12 57 31 50 - 12 57 31 50 - 12 57 31 50 - 12 57	STAGE STAGE	SA 71-0118 T9 170370- SA 71-0108 T9 170370- SA 71-0108 T9 170725 T
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PROVIDENCE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE PRESENTIALE	T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS ANDERSON COUNTY ANT CAM MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL ANT WARS MUNICIPAL THR MOY WARS MUNICI	######################################	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 13880 13880 13880 13880 13880 13883	72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72508 - 3 72208 - 3 72208 - 3 72208 - 3 72210 - 3 7231	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 271 284 280 224 280 224 280 224 281 274 281 274 281 274 281 274 281 274 281 274 281 274 281 274 282 134 282 134 282 134 282 134	2018 2018 2019 2019 2019 2019 2019 2018 2018 2018 2018 2018 2018 2018 2018	21 50 - 12 84 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 60 - 12 54 21 60 - 12 54 21 60 - 12 72 21 70 - 12 70 21 50 - 12 72 21 70 - 12 70 21 70 - 12 70	STAGE STAGE	SA 71-0118 TR 17-01379 TR 17-01379 TR 17-01379 TR 17-01379 TR 17-0157 TR 17-0
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON COUNTY APT CAR MUNICIPAL ABT WARS MUNICIPA	##11 ##1 ##1 ##1 ##1 ##1 ##1 ##1 ##1 ##	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 11260	72507 72507 72507 72507 72507 72507 72708 377208 377208 377208 377208 372208 3	41 4-48 41 41 4-48 41 41 4-48 41 41 41 41 41 41 41 41 41 41 41 41 41	371 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 080 024 080 024 080 024 080 024 081 074 081	0018 0019 0019 0019 2019 0019 2019 0018 0018 0018 0018 0018 0075 0075 0075 0075 0075 0075 0075 007	21 50 - 12 84 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 74 - 12 74 31 54 - 12 54 31 66 - 12 54 31 66 - 12 54 31 72 - 12 68 31 72 - 12 72 31 57 - 12 58 31 50 - 12 72 31 50 - 12 72 31 50 - 12 72 31 50 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 70 - 12 70 31 70 - 12 70 31 70 - 12 70	STAGE STAGE	SA 71-0118 TR 17-01379 TA 71-013 SA 71-013 SA 71-013 SA 79-08-59 TR 17-17-08 SA 75-24-49 SA 75-24-49 SA 75-24-49 SA 75-24-49 SA 75-24-49 SA 71-28-52 TA 71-28-52 TA 71-28-52 TA 71-28-53 T
PROVIDENCE PROVIDENCE	T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS ANDERSON COUNTY ANT CAM MUNICIPAL ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS TWINICIPAL RAPT WARS TWINICIPAL RAPT WARS TWINICIPAL RAPT WARS	## # # # # # # # # # # # # # # # # # #	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 113680	72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72508 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272208 / 272200 / 27200 / 27200 / 27200 / 27200 / 27200 / 27200 /	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 380 324 881 374 881 374	0018 0019 0019 2019 2019 2019 2019 0019 0019	21 50 - 12 84 21 64 - 12 73 21 68 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 54 - 12 56 21 80 - 12 56 21 80 - 12 50 21 72 - 12 72 21 72 - 12 72 21 80 - 12 71 21 66 - 12 71 21 66 - 12 71 21 66 - 12 71 21 67 - 12 71 21 70 - 12 70 21 57 - 12 51 21 70 - 12 70 21 57 - 12 51 21 70 - 12 70 21 70 - 12 70	STAGE STAGE	SA 71-0118 TP 07379 TP 07379 TP 07379 TP 0735
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON GOUNTY ABT CRA MUNICIPAL ABT WARS MUNICIPA	## ## ## ## ## ## ## ## ## ## ## ## ##	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 12860 12860 12860 12860 12860 12860 12860 12860 12860 12870 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	72507 72507 72507 72507 72507 72507 72708 377208 3	41 4-48 41 41 4-48 41 4-48 41 4-48 41 4-48 41 4-48 41 4-48 41 4-48 41	271 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 264 071 274 071 br>074 074 074 074 074 074 074 074 0	0018 0019 0019 2019 0019 2019 0019 0019 0018 0018 0018 0079 0079 0079 0079 0079 0079 0079 007	21 50 - 12 8- 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 50 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 70 - 12 70 21 72 - 12 72 21 60 - 12 71 21 60 - 12 71 21 60 - 12 72 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71	STAGE STAGE	SA 71-0118 TP 07379 T1-0703 SA 71-0703 SA 71-0703 SA 71-0703 SA 71-0705 T1-0705
PROVIDENCE PROVIDENCE	T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS T F GREEN ANT WARS ANDERSON COUNTY ANT CAM MUNICIPAL ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS TWINICIPAL THAN ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS GREEN-SPRAT ANT WARS TWINICIPAL RAPT WARS TWINICIPAL RAPT WARS TWINICIPAL RAPT WARS	# # # # # # # # # # # # # # # # # # #	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 11280	72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72507 - 72508 - 3722	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 271 371 27	2018 2019 2019 2019 2019 2019 2019 2019 2019	21 50 - 12 84 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 74 - 12 74 21 60 - 12 54 21 60 - 12 54 21 60 - 12 72 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 50 - 12 72 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 50 - 12 72 21 70 - 12 71 21 50 - 12 72 21 70 - 12 71 21 70 - 12 71	STAGE STAGE	SA T10118 TR T50378 TA T10703 SA T10703 SA T10703 SA T90855 TR T13902 T90725 A T52440 SA T51176.3 A T52440 SA T12919 TA T14015 SA T12919 TA T14010 SA T14140 SA T1440 S
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS WARDERSON COUNTY APT CAM MUNICIPAL ABT WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS	# # # # # # # # # # # # # # # # # # #	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 11360	72507 72507 72507 72507 72507 72507 72507 72507 72508 372208 372	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 371 264 381 324 380 324 380 324 381 374 381	2018 2019 2019 2019 2019 2019 2019 2019 2019	21 50 - 12 84 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 54 - 12 54 31 66 - 12 54 31 66 - 12 54 31 70 - 12 70 31 72 - 12 68 31 72 - 12 72 31 50 - 12 71 31 50 - 12 72 31 50 - 12 72 31 56 - 12 72 31 56 - 12 72 31 56 - 12 72 31 57 - 12 51 31 57 - 12 51 31 57 - 12 71 31 57 - 12 71	STAGE STAGE	SA T10118 TR T50378 TA T10703 SA T10703 SA T10703 SA T90855 TR T13902 T90725 A T52440 SA T51176.3 A T52440 SA T12919 TA T14015 SA T12919 TA T14010 SA T14140 SA T1440 S
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON COUNTY ABT CAM MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS MUNICIPAL ABT WARS TETROPOLITAN ABT WARS TETROPOLITAN ABT WARS TETROPOLITAN ABT WARS TETROPOLITAN ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS GREEN-SPART ABT WARS THORICIPAL ABT WARS FUNGICIPAL ABT WARS FOSS FIELD WARS FOSS FIELD WARS TOTOTT ABT	81 81 81 81 81 81 81 81 81 81 81 81 81 8	14765 14766 13860 7 13860 7 13870 7	72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72508 3 72208 3 72208 3 72208 3 72210	41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 284 371 371 284 371 371 371 371 371 371 371 371 371 371	0018 0019 0019 0019 0019 0019 0019 0019	21 50 - 12 8- 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 74 - 12 74 21 54 - 12 54 21 50 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 70 21 70 - 12 71 21 56 - 12 72 21 70 - 12 71 21 57 - 12 51 21 70 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71 21 57 - 12 71	STAGE STAGE	SA 71-0118 TP 07379 TP 07379 TP 07379 TP 0735
PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON GOUNTY ABT CAM MUNICIPAL ABT WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS	# # # # # # # # # # # # # # # # # # #	14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 14765 12860 12860 12860 12860 12860 12860 12860 12860 12860 12860 12860 12870 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 72508 / 372208 / 372	41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	271 76	0018 0019 0019 0019 2019 0019 0019 0019 0019	21 50 - 12 8- 21 64 - 12 73 21 66 - 12 72 21 72 - 12 72 21 72 - 12 72 21 74 - 12 74 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 54 21 60 - 12 72 21 72 - 12 72 21 72 - 12 72 21 73 - 12 73 21 66 - 12 73 21 70 - 12 70 21 72 - 12 72 21 70 - 12 70 21 72 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 72 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71 21 70 - 12 71	STAGE STAGE	SA 71-0118 T9 170379 T3 71-703 T3 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 79 1055 T9 71-015 T9 7
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PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS ANDERSON COUNTY APT CAM MUNICIPAL ABT WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS FOSS FIELD WARS MUNICIPAL ABT WARS FOSS FIELD WARS FOSS FIEL	## ## ## ## ## ## ## ## ## ## ## ## ##	14765 14766 113860 7 13870 7 1	72507 72507 72507 72507 72507 72507 72507 72507 72508 372208 372	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	371 76	0018 0019 0019 0019 2019 2019 2019 0019 2019 0019 0	21 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 74 - 12 74 31 54 - 12 54 31 60 - 12 54 31 60 - 12 54 31 60 - 12 72 31 77 - 12 72 31 77 - 12 72 31 77 - 12 72 31 77 - 12 72 31 78 - 12 72 31 78 - 12 72 31 79 - 12 72 31 79 - 12 72 31 70 - 12 74 31 70	STAGE STAGE	SA T1-0118 T9 17903 SA T1-0128 T1-0129 SA T1-0129 T1-0129 T1-0129 SA T31275 SA T31275 SA T31286 SA T12919 T1-015 SA T12919 T1-015 SA T12919 T1-015 SA T12919 T1-015 SA T12919 T1-015 SA T12919 T1-015 SA T12919 T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T1-015 SA T3-026 SA T3-026 SA T3-026 SA T3-026 SA T3-026 SA T3-026 SA T1-037 T1-046 SA T
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PROVIDENCE PROVIDENCE	T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS T F GREEN ABT WARS THOUSEDEL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINCIPAL ABT WARS TWINGIPAL THE ABT WARS TWINGIPAL THE ABT WARS TWINGIPAL THE ABT WARS TWINGIPAL THE ABT WARS TREEN-SPART ABT WARS TO THE TREEN THE TREEN TO THE TREEN THE TREEN TO THE TREEN THE TREEN TO THE TREEN THE TREEN TO THE TREEN THE TREEN TO THE TREEN THE TREEN TO THE TREEN TO THE TREEN THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN TO THE TREEN	# # # # # # # # # # # # # # # # # # #	14765 14766 171660 171660 171660 171660 171660 171660 171660 171660 1716	72507 / 72507 / 72507 / 72507 / 72507 / 72507 / 472508 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72208 3 3 72310 3 3 72310 3 3 72310 3 3 72310 3 7	41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 448 41 41 41 41 41 41 41 41 41 41 41 41 41	271 284 271 28	0018 0019 0019 0019 0019 0019 0019 0019 0019 0019 0019 0018 0018 0018 0018 0018 0018 0018 0029 0075 0056 0075 0056 0075 0056 0075	21 50 - 12 64 31 64 - 12 73 31 66 - 12 72 31 72 - 12 72 31 72 - 12 72 31 74 - 12 74 31 74 - 12 74 31 74 - 12 74 31 54 - 12 56 31 60 - 12 56 31 60 - 12 56 31 60 - 12 72 31 72 - 12 72 31 72 - 12 72 31 73 - 12 72 31 75 - 12 71 31 77 - 12 71	STAGE STAGE	SA T10118 T90378 T10703 T10703 T10703 T10703 T10703 T10703 T10855 T10905 T10907 T10907 T11903 T11903 T11903 T11903 T11903 T11903 T11903 T11910
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CHOZVILLE	"COMEE TYSON ANT LOAS	TN:	12891	77325	75 -GA	283 594	3297	31 56 - 12 70	STAR	SA	T:3054
KMGXAIFFE	MCSHEE TYSON ART WARS	771	:3691	72326	35 49M	383 594	0299	31 58 - 12 73	STAG	58	750621
7579413 205445145	INTERNATIONAL PAY WAS	TN.	13893	77334	35 J3M	389 SAM	3066	31 57 - 12 71	STAG	SA	713470
743HVILLE	SERRY FIELD MAR WARS SERRY FIELD MAR WARS	TH:	13897	72327	36 37M	286 41W	0177	01 50 + 12 54 31 56 - 12 70	STAR	a Sa	714424.47W 712881
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AG IL ENE	MUNICIPAL AFT WEAS	72	13962	72266	32 26M	299 414	0537	01 47 - 12 71	STAG	SA	701772
AG IL EME	MUNICIPAL APT WERS	TX.	13962	72268	32 36M	411- 680	0537	10 72 - 10 73	STAG	HSA	190309
WIND IFFG	ENGLISH FLO THE WARS	TX	23047	72363	35 14M	101 424	1099	01 55 - 12 54	STRQ	SA	750360
AUSTIN AUSTIN	MUELLER MAP WARS MUELLER MAP WARS	TX	13958	722544 72254	30 18M	097 42W	0189	01 57 - 12 71 01 59 - 12 73	SATS SATS	.78 28	714284 751101
DEEVILLE	CHASE FIELD HARS	TX	12925	14437	28 228	097 40M	0050	01 65 - 12 50	STAR	SA	750593
BEEVILLE	CHASE FIELD NAMS	TX	12925		26 22N	097 -QM	G250	31 55 - 12 70	STAR	Ä	713121
CORPUS CHAISTI	MAS	TX.	12926		27 41N	387 17W	0006	01 65 - 12 59	STAG	3A	T12761
CSTULLA OALLAS	MUNICIPAL APT CAR LOVE FIELD WOAS	TX TX	12947	72258	28 33WS	HIZ BEC :	0150	01 50 - 12 54	STAQ STAQ	SA SA	T50693 T13080
DALLAS	LOVE FIELD WAS	178	13960	72258	32 51M	396 51W	0156	01 57 - 12 71	STAG	-34	714101
DALLAS	LOVE FIELD WORS	TX	12860	72250	32 51M	086 51M	0150	05 72 - 04 73	STAG	•	T1-569
DALLAS	LOVE / IELD WAS	프	13960	72250	12 51M	396 514	0150	05 72 - 12 72	STAQ	Α -	T01772
CEL 218 EL 2458	LAUGHLIM AFB INTERNATIONAL APT WAS	TX 1	22001 33044	72261	29 22N	100 474	1200	Q1 65 - 12 69 Q1 50 - 12 64	STAR	5A 5A	T12761 T14602
EL 2450	INTERNATIONAL ART MAS	TX	23044	72270	31 46M	106 244	1196	01 72 - 12 72	STRE	5 A	101772
FORT HORTH	GREATER SM INL APT MORS	TX	23927	72259	32 50M	097 03M	0175	Q1 57 - 12 71	STAG	- T	752415
FORT WORTH	GREATER SW INL ART WARE	:31	22827	72258	32 50N	097 03M	0175	01 57 - 12 71 05 72 - 04 74	STAR	SA	714024
FORT MORTH FORT MORTH	GREATER SM INL ART WARS FERCHAM FLO WARS	픘	03927 13 96 1	77256	32 50M	097 03H	0175	09 72 - 04 74	STAQ STAQ	5A	752415 752383+3
GAL VESTON	SCHOLES FIELD WORS	TX	12923	72242	28 16M	084 PIH	0005	Q1 56 - 12 50	STAG	5A	71-432
SML VESTOR	SCHOLES FIELD WORS	프	12453	72242	29 16H	094 SIM	COOR	01 56 - 12 52	STAG	a	T1-1356
HGUST ON HGUST ON	CLLINGTON AFG CLLINGTON AFG	TX	13808	1	29. 37h 29. 37h	095 10H	0012	91 68 - 12 70 01 69 - 12 59	STAQ Staq	SA.	T90955.3 T12243
HQUSTON	MARK THE WAR	72	12918	72243	28 294	095 17H	2015	01 54 - 12 58	STAG	SA	T13874
WOUSTON	MOSSY IM, APT WAS	TX	12916	72243	38 38×	395 17H	0016	01 65 - 12 67	STAG	SA	T13425
MGUSTON	INTERCONTINENTAL APT WAS	IX	12950	77243	29 50A	G95 224	0033	08 59 - 12 71	STAG		714191
HOUSTON +	INTERCONTINENTAL APT WORS	TX	12960 12960	72243	29 59M 29 59M	095 22M	0033	08 59 + 07 72 09 59 - 12 71	STAQ STAQ	`A SA	T1=569 T13813
HOUSTON	INTERCONTINENTAL APT WARS	12	12960	72243	29 56N	395 22M	0033	09 71 - 12 73	STRE	1354	750174
HOUSTON	INTERCONTINENTAL APT WARS	TX	12960	722-13	29 59H	095 22H	2033	08 72 - 12 72	STRE	A	T01772
udustan	INTERCONTINENTAL APT WAS	12	12960	72243	29 50M	382 SSH	0033	06 72 - 07 73	5749	A	T14569
LAREDO LUFKIM	AFG ANGELIMA COUNTY APT FSS	쭚	12907	72252	27 32N 31 14A	094 28H	0154	04 65 - 03 70 91 67 - 12 71	STAR STAR	SA ma	T12761 T14443
MIDL AND	MID-GOESSA AGL ATL MAS	TE	33033	72269	31 564	102 134	0875	01 60 - 12 64	STAG	SA	T13931
MIDÇAMO	MID-GESSA GGL ATL MARS	TX	23023	72265	31 56M	102 124	0875	01 71 - 12 71	STRA		701772
PORT ARTHUR SAN ANGELS	SEFFERSON COUNTY APT WARS	17	12917	72241	28 57N 31 22N	100 30H	0509	01 57 - 12 71	STAG STAG	SA SA	T01772.141 T13931
SAM AMTOMIO	INTERNATIONAL ART WAS	TX	12921	72253	29 32H	098 38W	0243	01 60 - 12 54	STAG	SA AZ	713931
TYLER	POUNDS FIELD CAR	TX	13977		32 22M	385 2-4	0173	Q1 5Q - 12 54	PATZ	SA	T51272
V[CT09/A	FOSTER AFB	†x	12912	72255	28 518	396 55-	0031	01 55 - 12 74	STAR	SA	75225-4
-AC3	MUNICIPAL APT MARS	TX.	13954	72256	31 37M	087 132	0155	01 65 - 12 73	STRQ	746	751101
BOTCE CANTON	CAR	UT	23159	}	37 42M	112 0944	2317	01 49 - 12 54	STAG	SA	T13029
DEL TA	MUNICIPAL ART CAR	UT	23162	72479	38 53W	112 314	1452	31 90 - 12 54	STAR	SA ·	712761
HARKSVILLE MILFORD	CAR HUNICIPAL RAT CAR	UT	23170 23176	72473	38 25M	112 018	1534	01 49 - 12 54	STAQ STAQ	SA	T:3029 751121
BEDEN	HILL- AFB	UT	24101	72575	41 07%	111 5eu	1450	01 65 - 12 59	STRE	SA	T12906
SALT LARE GITY	INTERNATIONAL ART WORS	UT	24127	72572	-0 -6 #	111 56⊭	1296	01 40 - 12 40	STAR		T:36 50
SALT LAKE CITY SALT LAKE CITY	ZADE TAR JANGITANGSTKI ZADE TAR JANGITANGSTKI	UT	24127	72572	40 46M	111 561	1296	01 49 - 12 49	STRE STRE		7136 56 7136 5 6
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SALT LAKE CITY	INTERNATIONAL APT WORS	UT	24127	72572	40 468	111 56H	1296	01 52 - 12 52	5789		T12658
SALT LAKE CITY	SABU TAR JAMBITAMASTKI	UT	24127	72572	40 46N	111 584	1296	91 53 - 12 53	STAR	4	T12656
SALT LAKE GITY SALT LAKE GITY	EADH TOR JANGITANGITKI ZABW TOR JANGITANGITKI	UT	24127 24127	72572 72572	40 468	111 56W	1267	01 54 - 12 54	STRQ STRQ	A A	T13658 T13658
SALT LAKE CITY	ALEMATICAN ART MAS	UT	24127	72572	40 458	111 589	1287	31 56 - 12 56	STRE		T13656
SALT LAKE CITY	INTERNATIONAL ART LAAS	UΤ	24127	72572	40 458	111 SOM	1287	01 57 - 12 57	STAR	9	713658
SALT LAKE CITY	ZAG- TQA JANG!TANGSTK:	UT	24127	72572	40 468	111 564	1287	31 58 - 12 58	5788		713656 713656
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SALT LAKE CITY	THTERMSTIDHEL APT MASS	UT	24127	72572	-0 -6#	111 50W	1287	31 70 - 12 72	STAR	2 8	T01772
SURL INGTON	INTERNATIONAL APT MAS	VF	14742	72617	26H	073 09W	0106	01 65 - 12 69	STAG		712179
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